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U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF EXPERIMENT STATIONS—BULLETIN 216.

A. C. TRUE, Director.

IRRIGATION IN IDAHO.

BY

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PREPARED UNDER THE DIRECTION OF

SAMUEL FORTIER,
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GOVERNMENT PRINTING OFFICE.
1909.

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U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., June 3, 1909.

SIR: I have the honor to transmit herewith a report on irrigation in the State of Idaho, prepared by James Stephenson, jr., State engineer of that State, under the direction of Samuel Fortier, chief of irrigation investigations of this Office. This is one of a series of reports giving the present status of irrigation in the several arid States. There is a very large call upon this Office for general information regarding the opportunities for settlement on irrigated lands in these States, the cost of land and water and of establishing homes on these lands, and regarding the crops grown. The attempt has been made to include in each of these reports as nearly as possible all the information which will be needed by parties contemplating settlement in the State to which it refers. It is recommended that the report be published as a bulletin of this Office.

Respectfully,

A. C. TRUE,
Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

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IRRIGATION IN IDAHO.

INTRODUCTION.

The State of Idaho embraces an area of 84,800 square miles, or 54,134,000 acres, and in size it ranks twelfth in the Union. It is almost as large as Ohio and Pennsylvania combined, is larger than New York and Maine together, and exceeds in area the six New England States, with Maryland included. Its smallest county is almost as large as Rhode Island, while its largest one is larger than Massachusetts. From north to south Idaho measures 487 miles, its width varying from 48 miles on the northern border to 309 miles on the southern. (Pl. I.)

The general character of the country is mountainous, with a gradual slope to the west from the main range of the Rocky Mountains, which define the eastern boundary of the State. The Columbia River and its tributaries drain the entire area, except a small section in the southeastern part of the State which is drained by Bear River, a tributary of Salt Lake. The State is naturally divided into two topographical divisions or districts, the northern and the southern. The former consists of that portion of the State drained by the Salmon, Clearwater, Spokane, and Kootenai rivers, while the latter, consisting of the great Snake River Valley, is drained by the Snake and its tributaries. Geologically considered, a great difference is to be observed between these two divisions, a difference resulting in a marked dissimilarity of natural resources. The southern division depends almost wholly on irrigation, the water supply being afforded by Snake River, which makes possible the cultivation of a large acreage which otherwise would be entirely unfit for any purpose except grazing. The tract thus benefited by this water system is about 350 miles long and 100 miles wide. The North Fork of the Snake rises in Henry Lake, located close to the State line between Idaho and Montana. The South Fork rises in Jacksons Lake, south of Yellowstone Park. From the confluence of these forks the Snake flows southwesterly 150 miles and then runs nearly west across the State, finally turning north and forming the Idaho-Oregon State line from a point in Canyon County to Lewiston. From its source to American Falls the banks of the river are generally low and the fall is rapid, allowing the easy construction of irrigation canals for the

reclamation of the fertile benches lying along the river. Beginning at American Falls the banks become higher, until finally about 100 miles farther west the river plunges into a canyon more than 50 miles in length. In this canyon is found a number of notable falls, the first of any size being Twin Falls, with a vertical drop of 187 feet. Five miles farther west the river passes over another precipice 210 feet high, forming Shoshone Falls, while within the next 25 miles are found Auger Falls and the Upper and Lower Salmon Falls. The power resources afforded by these cataracts are stupendous. They are being developed rapidly by capitalists.

The northern division of the State referred to above is very rough and mountainous and is everywhere timbered heavily. The late Professor Hayden, of the United States Geological Survey, describes this portion of the State as a "vast, wedge-shaped table-land rising up from the west to a height of 10,000 feet in the east and literally crumpled or rolled up in one continuous series of mountain ranges, fold after fold." In this section is found the greatest forest of white pine now in existence, besides millions of acres of cedar, tamarack, and hemlock. In this section are found also large lead and silver mines. This section also produces large quantities of gold.

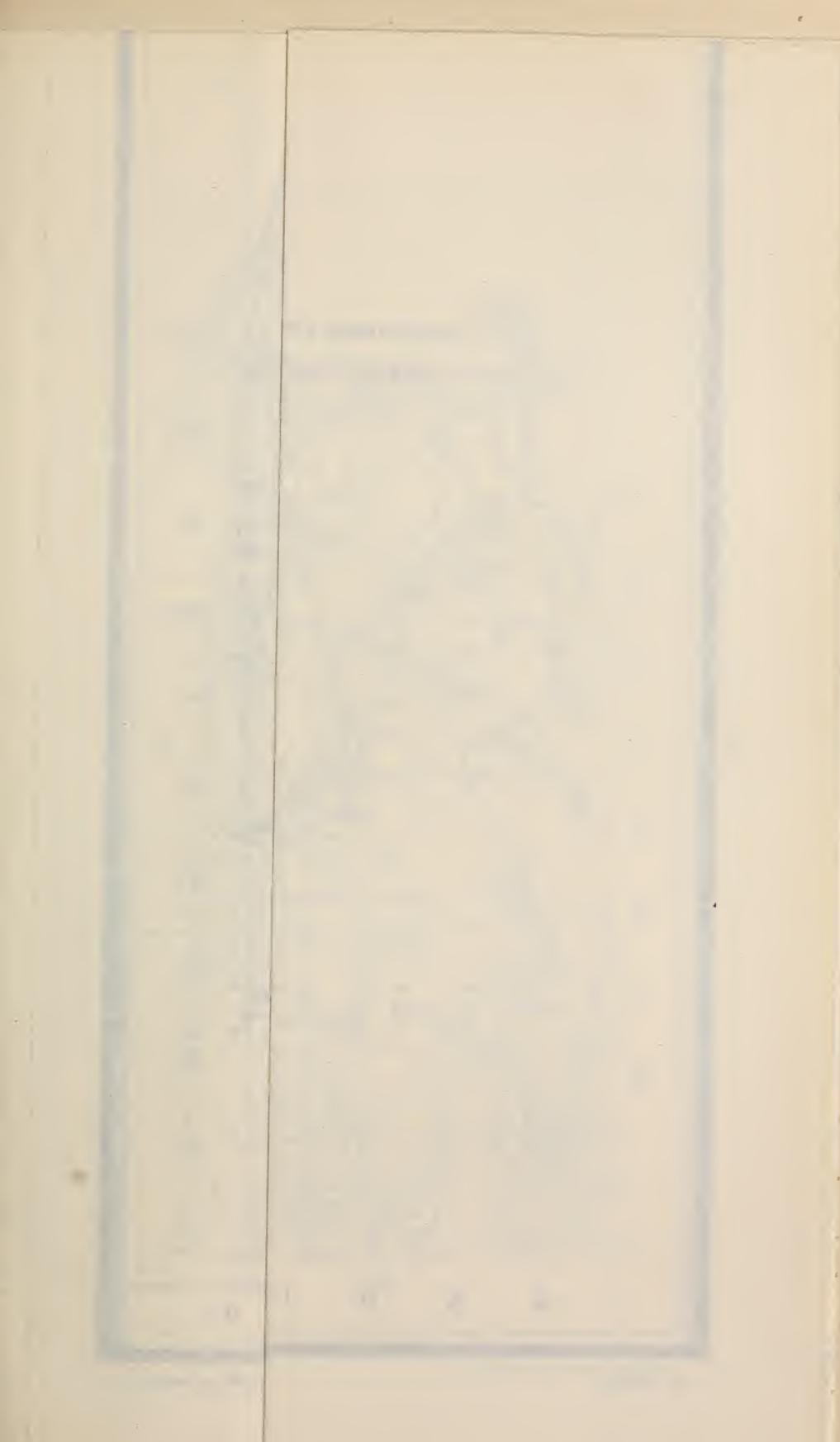
Agriculture, stock raising, mining, lumbering, and horticulture constitute the five leading industries of the State. An excellent impetus has been given along all these lines within the past five years by the influx of capital and labor seeking opportunity and employment. This is true notably with reference to agriculture, owing to the development of very large irrigation projects, both by the Government and by private capital, under the provisions of the act of Congress passed in 1894, commonly known as the "Carey Act."

Idaho has a varied climate, chiefly due to the great diversity in altitude. Lewiston, on the western border of the State, is only about 750 feet above sea level, while on the eastern border the crest of the mountain ranges reaches a height of more than 10,000 feet, Hyndman Peak being 12,078 feet above sea level. The average elevation of the State is about 4,500 feet. The air in all portions of the State is generally dry and highly rarefied.

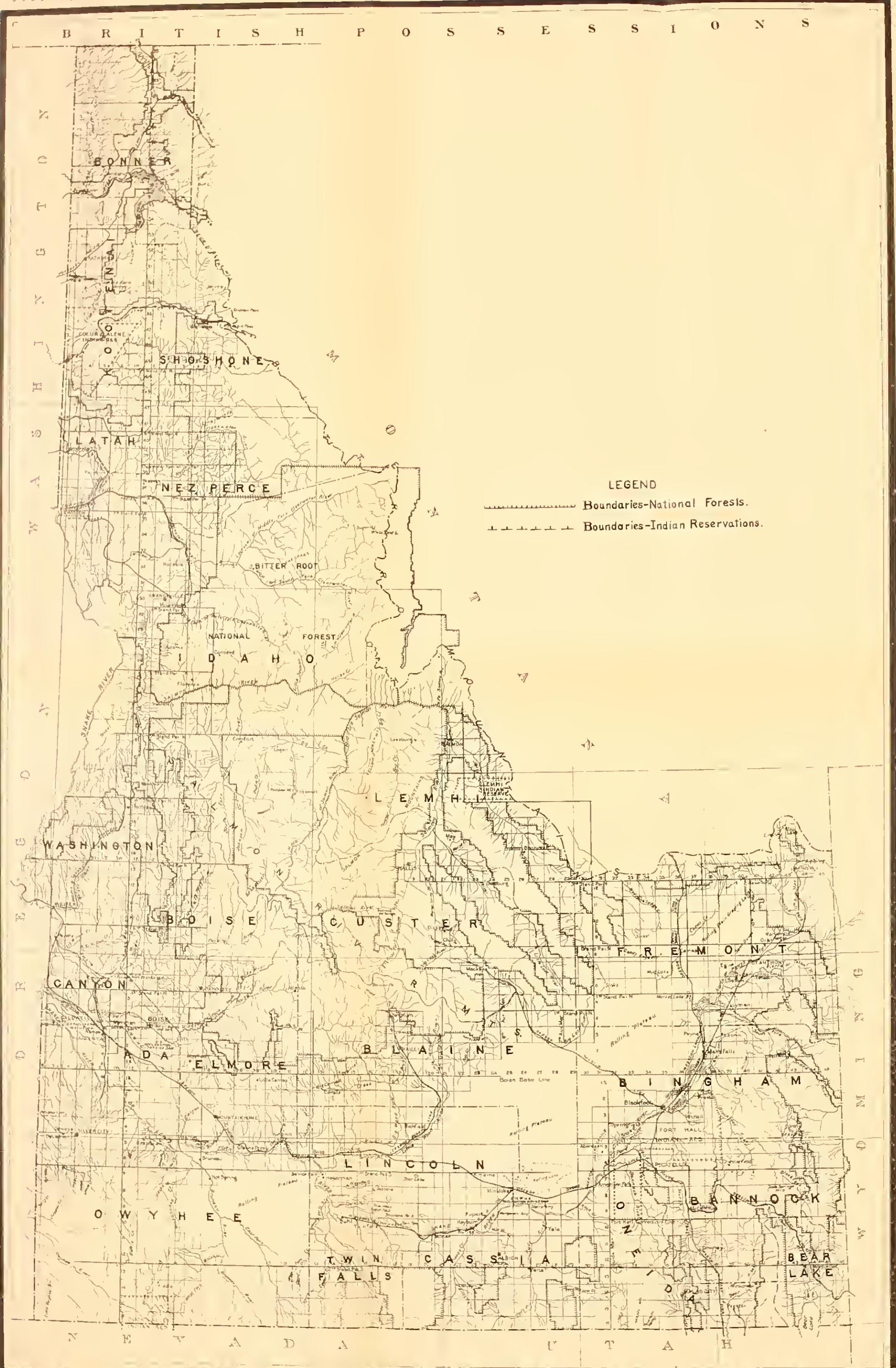
The assessed valuation of the property in the State, as established in August, 1908, by the State board of equalization, is as follows:

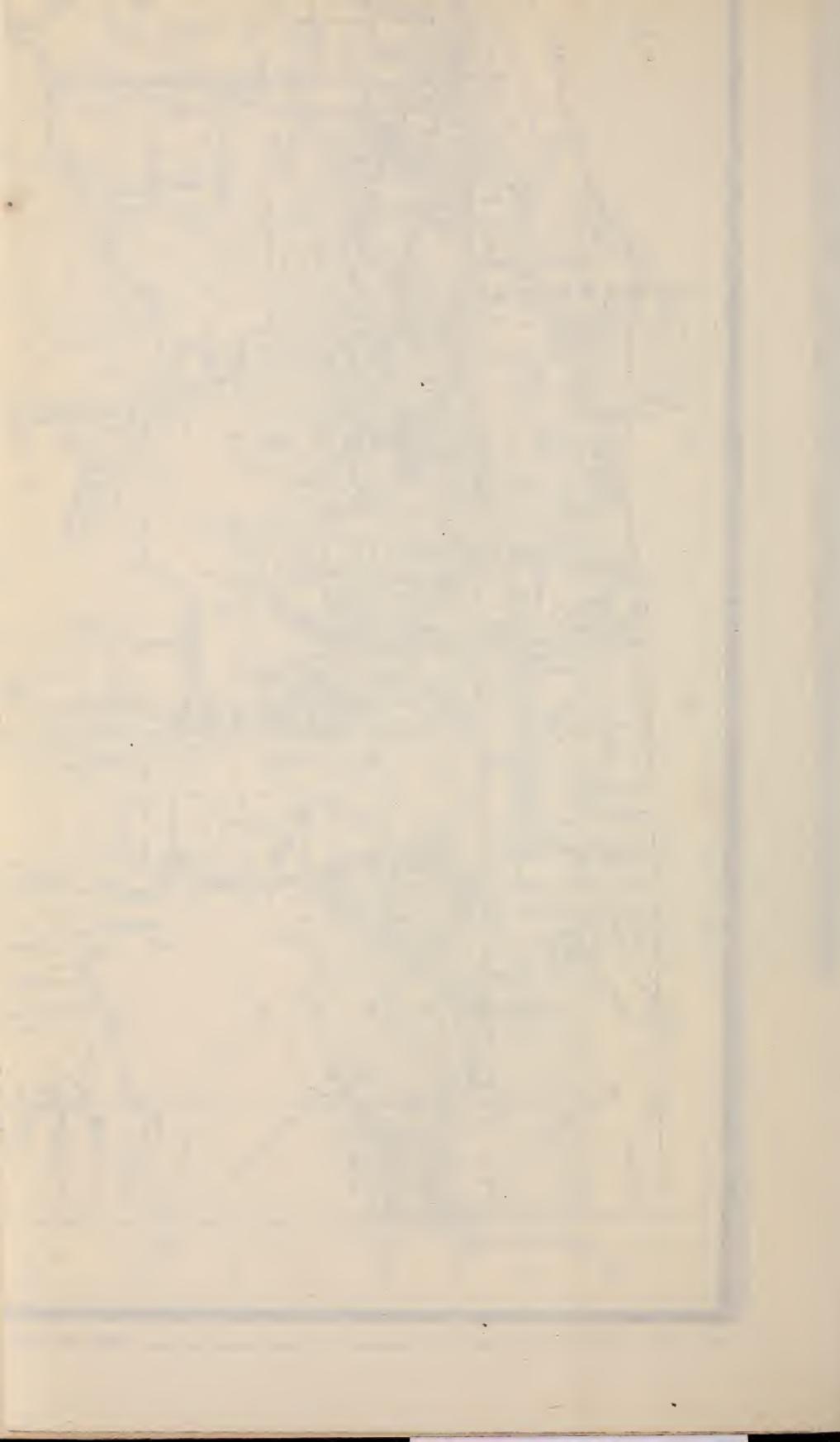
Railroad lines-----	\$19,058,784.80
Telegraph lines-----	366,304.48
Telephone lines-----	665,696.86
All other property-----	95,589,270.76
Total -----	115,680,056.90

The above total is an increase of \$48,206,170.40, or 72 per cent, over the valuation in 1904.









The revenues of the State for the year 1908 were:

Gross-tax revenue	-----	\$500,000.00
Special-tax revenues	-----	262,562.35
Total	-----	762,562.35

Idaho at present has 1,918 miles of railroad, the chief lines being the Oregon Short Line, the Great Northern, Northern Pacific, and Spokane International. There is within the State 6,888 miles of telegraph lines and 16,613 miles of telephone lines.

CLIMATE.

There are parts of the State where the winters are intensely cold, but in the valleys they are much milder than those experienced in the same latitude farther east. The State, lying as it does on the western slope of the Continental Divide and protected throughout the entire length of its northern border by such mountain ranges as the Coeur d'Alene, the Bitter Root, and a part of the main range of the Rockies, is not subject to the sudden cold waves that sweep down from the north over the States on the eastern slope. In common with the Pacific coast region, it is comparatively free from severe thunderstorms and practically free from tornadoes. High winds are known to occur on the open plains, but in the sheltered valleys the winds are usually light. During the winter there is considerable cloudiness, and in some of the valleys fog is not infrequently experienced. In the summer, particularly in the southwestern part of the State, the sunshine is almost uninterrupted for days at a time.

In Idaho altitude is a far more important factor in determining climate than longitude or latitude. Ordinarily one finds lower temperature and less moisture as the altitude decreases, though there are some notable exceptions to both rules. This being true, it is evident that any general statement made relative to the climate of the State, or any district in the State, should not be interpreted as being descriptive of every part of the State, or every locality in the district.

TEMPERATURE.

The coldest part of the State, having a mean annual temperature slightly below 36° F., includes the main range of the Rocky Mountains and parts of the sparsely settled mountainous region in the central part of the State. If sufficient data were available, it is probable that the area having a mean annual temperature below 36° F. would include the Bitter Root Range and at least a part of the Coeur d'Alene Mountains. What is said of the climate of this area applies, partly at least, to the climate among the higher peaks of the Owyhees, the Seven Devils, and numerous lesser ranges. In these mountains the

climate is characterized by cold, snowy winters, and cool, short summers. Though the weather is sometimes very warm on bright summer days, the summer nights are almost invariably cool enough to make a fire enjoyable.

Somewhat warmer than the mountainous regions are the extensive plateaus and higher valleys that form a large part of the central and extreme southern and eastern portions of the State. On these plateaus and in these valleys the winters are cold and the summers are comparatively short, but still usually long enough to permit a good growth of grasses, and in many localities of sufficient length to enable the staple grains to come to maturity.

In that part of the great Snake River Valley lying above Shoshone Falls the climate is characterized by moderately cold winters and moderately warm summers. Here the staple grains and grasses grow in abundance, and in places hardy fruits are produced.

The Snake River Valley from Shoshone Falls to the western boundary of the State, together with the lower valleys of the stream emptying into this part of the Snake, constitute what are known as the "southwest valleys." Here are found mild winters and summers that are characterized by periods of intense heat during the daytime, though the nights are rarely uncomfortably warm. These valleys are the home of the apple, pear, prune, and other fruits. Here there is little danger to fruit trees from winterkilling, but late spring frosts occasionally cause some damage where preventive measures are not taken.

The northern part of the State contains much rolling country, where the climate is much more like that of some of the Central States, though the difference between the summer and winter temperatures is not so marked as it is in the States east of the Rockies. In some of the lower valleys, particularly around Lewiston, which is situated at the lowest point in the State, the climate is very mild and well adapted to fruit growing. The chief climatic drawback in these low valleys is the occurrence in winter of periods of weather sufficiently warm to start prematurely a growth of the fruit buds.

Lake, Fremont County, at an elevation of 6,700 feet, is the coldest point for which a record is available, with a mean annual temperature of 36° F., and Garnet, Elmore County, at an elevation of 2,575 feet, is the warmest point, with a mean annual temperature of 55.4° F. Lake is situated near the summit of the main range of the Rocky Mountains, while Garnet is in the Snake River Canyon. The lowest temperature ever recorded in the State was 48° F. below zero, at Chesterfield, Bannock County, on February 12, 1905, and the highest ever recorded was 115° F. at Hagerman, Lincoln County, on July 30, 1900.

FROSTS.

One of the most important climatic elements to be considered is the probability of the occurrence of severe frosts at times when vegetation is susceptible to injury from such frosts. In the fruit-growing regions of the State there is little to fear from fall frosts, for severe frosts do not ordinarily occur in the fall until the fruit crop is sufficiently mature to be out of danger from that source. The principal danger is from late spring frosts, but this is not so great as might at first appear from the records. A killing frost is one that is destructive to the staple crops of a community. If no such frosts occur during the spring, the latest date on which freezing temperature occurs is taken as the date of the last killing frost in the spring. Therefore it frequently happens that the record shows a killing frost on a late date, when the nature of the frost was not such as to render it seriously destructive to the staple fruits, for except at critical periods most fruits will withstand a temperature several degrees below freezing for a short period. This is especially true in Idaho, where the nights are uniformly cool and all vegetation becomes somewhat inured to moderately low temperature. Late spring frosts in Idaho usually follow a rain; thus they occur at a time when there is a good supply of moisture present, and it is not an unusual thing for clouds to form in the morning after a cool night, thus mitigating the damage done by the frost. Frosts usually form during still nights, rendering the practice of smudging as a protective measure highly effective. In very few instances has any great loss resulted when protective measures have been thoroughly and intelligently resorted to.

PRECIPITATION.

What has already been said relative to the difficulty encountered in trying to describe the climate of a State, the surface of which is so broken, is especially true in its application to precipitation. In general, the precipitation is greatest in the northern part of the State, varying from more than 35 inches annually in the Coeur d'Alene Mountains to about 25 inches near the western border. Another region of relatively heavy precipitation, amounting to more than 25 inches annually, includes the Seven Devils Mountains and parts of the great grain-growing region in Idaho County. The driest parts of the State are to be found along the Snake River, from below Shoshone Falls nearly to the western boundary, and in the Lost River region.

During the winter months the prevailing westerly winds, coming from the relatively warm regions of the Pacific Ocean, are cooled as they blow over this region. By this means, assisted by the influ-

ence of well-defined areas of low barometric pressure that in winter move eastward from the Puget Sound country, and those that occasionally move up from the south, these winds are led to part with a large part of their moisture before crossing the Rocky Mountains. Hence in winter there is a high rate of cloudiness in Idaho, and rain, though usually falling in small amounts, is of frequent occurrence in the valleys, while in the mountains the snow accumulates in great quantities. Toward spring these forces are less active and there is a falling off in the frequency of rainfall. In May there is a secondary maximum which, taken together with the fact that the run-off from the melting of mountain snows is greatest in May and June, renders the problem of storage of water for irrigation a comparatively simple one, since the maximum flow of streams occurs within two or three months before the driest part of the year.

In summer the prevailing westerly winds, coming from the relatively cool ocean and blowing across a warm land surface, have little opportunity to become cooled below their dew-point, thus permitting the formation of cloud and rain. Then, too, the paths of the northern low-pressure areas lie too far north for these depressions to assist materially in the rain-producing process, and such depressions as approach the State from southwest and south are too weak to cause any general precipitation. The result is that over a large part of the State the summer rainfall is not sufficient to permit successful farming without irrigation. Notable exceptions to this are the rolling lands of northern Idaho and some of the plateaus and high valleys in the central and eastern districts. That farming without irrigation is successful in some of these districts, however, is due in a large measure to an adequate summer rainfall.

Where moisture sufficient for crop production is available by irrigation and conservation the absence of rain in the growing season is a distinct advantage. It makes it possible to put alfalfa into the stack looking almost as green as when it stood in the field, and the wheat may be left sacked in the field until there is time to market it. It renders spraying for fruit pests most effective, and the almost uninterrupted sunshine of the southwest valleys gives to such fruits as the Jonathan apple a color that is unsurpassed.

The wettest point in the State for which a record is available is Murray, Shoshone County, with a mean annual precipitation of 38.29 inches. Murray is situated in the Coeur d'Alene Mountains at an elevation of 2,750 feet. The driest point for which a record is available is Garnet, Elmore County, which is also the warmest point. Garnet has a mean annual precipitation of 6.31 inches. The wettest month on record for Murray was November, 1896, with a total precipitation of 11.12 inches, and the driest month was July, 1900, when only a

trace occurred. The wettest month on record for Garnet was October, 1901, with a total of 2.02 inches, while it frequently happens that July and August pass at that station without the occurrence of a measurable amount of precipitation. The winter precipitation in Idaho usually occurs in small amounts at frequent intervals. What precipitation occurs in summer is in larger amounts, but the intensity of the rainfall even in summer is far less than in States farther south in the intermountain region, and cloudbursts, so-called, occur very rarely.

GENERAL TOPOGRAPHY.

The chief feature in the topography of the State is the range of mountains running from northwest to southeast along the Idaho-Montana line, with spurs leading off to the west. One of the principal lateral ranges branches off and extends near the southern boundary of the State and nearly parallel to it. About 250 miles farther north is another spur. Both of these ranges extend across the State from east to west. Smaller spurs branch off from these ranges from north to south, but leave between the wide valley of the Snake River, which extends from east to west across the entire State. With the exception of an area of about 4,000 square miles, situated in the southeast corner of the State, and which drains into the Great Salt Lake Basin, all of the arid land in Idaho lies within the drainage basin of the Snake River, and this river and its tributaries must furnish water for all lands irrigated in this region, two-thirds of the water supply coming direct from Snake River.

RIVERS USED FOR IRRIGATION.

That portion of Idaho in which agriculture can not be carried on without irrigation embraces an area of over 65,000 square miles, or about 77 per cent of the total area of the State. Although agricultural crops will not mature in this region without irrigation, the country in its natural state is by no means a barren desert. The mountains are clothed to their very summits with rich herbage, while the great plains, the most arid portions, are covered with bunch grass, which supports thousands of horses, cattle, and sheep.

The region designated the arid portion of Idaho embraces the entire southern part of the State, extending as far north as the Salmon River in Idaho County, and throughout the entire course of the Snake River, although along the lower portion of this stream irrigation is confined to the valley proper, as at Lewiston, in Nez Perce County, which comprises but a very small proportion of that district.

The lands now being irrigated are very much the same in character throughout this entire region, the surface is generally quite level, the

soil is of volcanic origin, very warm and porous, absorbing water very readily, quick to respond to cultivation, and fertile to a degree that would satisfy the desires of any farmer from the rich bottom lands of the east. So uniform is the character of the soil throughout this region that but little interest is taken in its examination by the settler. It is all good, the serious question being the water supply.

In the arid portion of the State, without irrigation, agriculture, and hence permanent settlement, could not be thought of. In many cases the construction of the indispensable canal is beyond the ability of any one individual and can only be accomplished by combined effort. Irrigation works of great magnitude have been planned and successfully carried through in this manner. In some cases it has been found impracticable to construct works of great magnitude. Here the individual settler can not obtain a foothold unaided, since no water can be diverted without the expenditure of many thousands of dollars, sometimes millions. In such cases capital has to assist, as it has done frequently and is doing at present, by going in advance of the settler and making conditions possible for his coming. Under this head come the various Carey Act enterprises which have been so notably successful in their operations in this State, of which more extended mention is made hereafter.

In this manner and by these means the arid portion of the State has been settled, when the difficulties were not great, by individual effort; when serious obstacles had first to be overcome, by community effort; and when the preliminary work was beyond the resources of the community or in the absence of a community, through the efforts of capital.

SNAKE RIVER.

Above American Falls the Snake River possesses a drainage basin of about 13,000 square miles, extending east and south from the river. Nearly this entire area lies at an elevation of 4,700 to 9,000 feet, while the mountain peaks rise to an elevation of over 12,000 feet. The snowfall is very heavy and lies until late in the spring. While the elevation of the watershed is great, the surface for the most part consists of high, rolling ridges and wide basins, and but a small percentage is occupied by precipitous slopes or rugged mountains. Consequently the river is very regular in its habits, and, fortunately for the irrigator, the flood occurs rather late in the season. Harvesting of grain begins during the early part of August throughout the upper portion of the valley and from this time on the demand for water greatly decreases.

During the last quarter of a century this upper portion of the valley has been very largely developed by individual, community, and cor-

porate enterprise. It has been only within the last few years that any attempt has been made to reclaim any considerable portion of land west of American Falls. But at the present time the greatest activity in irrigation development is to be found in that portion of the valley lying immediately to the west and south of Montgomerys Ferry, in the south central portion of the State. All of this work has been done and is being done by the Government under the Reclamation Service and by private capital under the conditions of the Carey Act. Through these two agencies hundreds of thousands of acres are being reclaimed, thrown open for settlement, and irrigated which until very recent times were considered to be entirely useless for purposes of irrigation.

The first agency to enter this field was the Twin Falls Land and Water Company, which proceeded to spend upward of \$2,000,000 in the building of diversion works and canals for the irrigation of nearly a quarter of a million acres in Cassia County. Then followed the Reclamation Service in the development of what is known as the Minidoka project. It was in turn shortly followed by the Twin Falls North Side Land and Water Company, which is developing a very large irrigation system on the north side of the river in Lincoln County. These three projects will be treated more fully hereafter.

SALMON RIVER.

Most of the irrigated lands along the Salmon River are in Custer and Lemhi counties, in valleys which lie at an elevation of 4,000 to 6,000 feet, surrounded by high mountains. Hitherto agriculture in Custer County has been confined chiefly to the valleys of the Salmon and the Pahsimari rivers, and in Lemhi County along the Salmon and Lemhi rivers.

The principal development along the Salmon River in Custer County is in the vicinity of Challis. Here several ditches have been taken out, some costing several thousands of dollars, but owned for the most part by individuals. There is always a good supply of water in the Salmon River.

The developments on the Pahsimari River are chiefly in the vicinity of Morse and Goldburg. There is a large amount of good land in this valley that can be developed by irrigation.

LOST RIVER.

On the north side of the Snake River Valley is an area of about 4,000 square miles, drained by several streams, some of considerable size, which at one time evidently formed the branches of an important tributary of the Snake River. It is probable that the channel of this

tributary was in a former age covered up by the great lava sheet which is found throughout that section and the waters now find their way to the Snake River by subterranean channels. The principal streams forming this now disconnected drainage system are Big and Little Lost rivers, Birch, Blue, Medicine Lodge, Beaver, and Camas creeks. The mountains drained by these streams rise to elevations ranging from 8,000 to 12,000 feet.

The water supply is derived from the melting snows and depends entirely upon the amount of snowfall each year. Some seasons the snow goes off early and the irrigating season is short. Nearly the entire normal flow of these streams is utilized. Good land is very plentiful, consequently the normal flow of the streams is overtaxed. The soil is of excellent quality, and fine crops of hay, wheat, barley, oats, potatoes, apples, small fruits, and all kinds of vegetables are raised. Stock raising is the principal industry, the neighboring mountains affording an excellent summer range.

While, as above stated, the normal flow of Big Lost River has been practically exhausted by appropriations for irrigation, until recently no attempt has ever been made to save the extensive flood waters which each year disappear beneath the surface and are lost to any useful purpose. However, there is under way at the present time a project which, by means of a reservoir system, will save these waters, thus making it possible to irrigate a tract of about 10,000 acres. A more extended description of this is given on page 53.

WOOD RIVER.

That section known as the Wood River country, north and west of Big and Little Wood rivers, lies at an elevation of 4,000 to 6,000 feet, the mountains rising to a height of over 9,000 feet. The lower portion of this section lies along the border of the lava fields of the Snake River Plains and the foothills of the high mountain ranges to the west and north. The upper portion consists of the high, narrow valleys of the Big and Little Wood rivers, and the high plateau, Little Camas Prairie, drained by Camas Creek. These rivers, with their numerous branches, drain the southeastern slope of the Sawtooth Mountains. After reaching the plains they flow through channels cut deep in the lava or through narrow valleys, which have been leveled up by their own deposits. They join near the town of Gooding and form the Malad River, which, after a course of about 12 miles through deep canyons, empties into Snake River. The country on either side of the lower courses of these streams is an undulating plain, with outcroppings of lava on the ridges, without any well-defined system of drainage. Much of the surface drainage ends in shallow basins, the bottoms of which are covered by a siltlike soil.

Irrigation has been carried on in this section for many years, but until recently no attempt was made to utilize other than the normal flow. There is under way, however, at the present time a project which contemplates the conservation of the flood waters of Big Wood River under the Carey Act. These waters will be amply sufficient for the irrigation of a very large tract of land. A more detailed description of this enterprise will be found on page 49.

THE MOUNTAINHOME SECTION.

The northern portion of Elmore County includes within its limits more than one-half the watershed of Boise River, the South Fork of that river running through the middle of the section from east to west. The mountains along the south side of this stream are low and, in fact, are almost one-sided, the north slope falling off precipitously toward the river, while the descent on the south side soon flattens out into the great plateau which stretches south toward the Snake River. The greater portion of this table-land has an average elevation of about 3,100 feet and is from 600 to 800 feet above Snake River. These high lands are drained by several little streams which head in the low hills to the north and empty into the Snake.

The Great Western Beet Sugar Company is at the present time developing a system of reservoirs which will conserve an ample water supply for the irrigation of a large body of excellent land.

BOISE RIVER.

The Boise River constitutes the main source of water supply for the Boise Valley, the largest body of irrigable land in southwestern Idaho, one of the largest bodies in the arid region. This valley in fact is simply the widening out of the great Snake River plains. The irrigable portion of the valley consists of the valley proper, a bottom 1 to 2 miles wide extending from the Boise Canyon to the mouth of the river, a distance of about 60 miles, and a series of benches from 1 to 5 miles wide, starting on the south side with an elevation of 25 to 70 feet above the river and rising one above the other and terminating in a ridge about 2 miles from the Snake River and parallel to it. These benches slope slightly and all have a general slope toward the river. The lower end of the valley joins the lower benches of the Snake River. These benches are irrigated by canals taken from the Boise River.

The United States Weather Bureau reports an average rainfall at Boise of about 14 inches. At Nampa, the center of the irrigable portion of the valley, it is but half that amount and less than 1 inch

falls during the hot months of June, July, and August. This condition of aridity gives a general character to the climate which can not be appreciated by one living in a humid region. The atmosphere is always dry and pure, the days are hot in summer but the nights are cool, while the sky is hardly ever overclouded for any length of time. The winters are usually open, and the occasional snowfalls, which are generally light, remain upon the ground for only a few days. It is hardly ever necessary to feed grain to stock for more than three months, and frequently stock is allowed to run out all winter. Seeding usually begins early in April, and harvest from the last week in July to the middle of August. Three cuttings of alfalfa are obtained during the season and two of timothy and clover. Fruit is sometimes damaged by late frost, but the range of products is so wide that losses sustained from this source are not heavy, nor are they general. The percentage of failures from causes which can not be prevented is probably not greater than is suffered from time to time in the best-known fruit districts in the United States. Generally speaking, the climate of the Boise Valley, as it affects the fortune of the agriculturist, is very similar to that of the Payette and Weiser valleys.

The Boise River, the source of water supply for the valley bearing its name, rises in the Sawtooth Mountains. The area of its drainage basin, which lies at an elevation of 4,000 to 9,000 feet, is about 2,450 square miles. The greater portion of this is well timbered, and in high elevations where it is plentiful the snow lies until June and July. In the lower elevations and foothills the snow disappears under normal conditions during the month of May, hence the flood-water season begins during that month, reaching its highest mark during June and lasting until the middle of July. Like all mountain streams whose chief source of supply is the melting snow, the Boise quickly subsides after its highest stage is reached and the period of low water soon follows.

Irrigation has been developing in this valley from the early sixties, under individual and community effort at the outset, followed by corporate enterprise, which in turn has been succeeded by the work of the Reclamation Service, which, at the present time, is unifying and developing to a higher degree the various water systems. The work of the Reclamation Service will be treated more at length elsewhere.

PAYETTE RIVER.

The Payette River, through the lower portion of its course, flows through the Payette Valley, one of the tributary valleys of the Snake

River, which lies at an altitude of 2,100 to 2,800 feet. The irrigable portion is about 30 miles long, averaging about 5 miles in width, and contains about 85,000 acres, which includes a strip of land extending down Snake River Valley toward Weiser, but irrigated from the Payette River.

The soil is a sandy loam of volcanic origin usually of great depth. In its natural condition it is covered with a heavy growth of sagebrush. The irrigated bench lands lie 10 to 100 feet above the river. The surface is usually smooth and easily prepared for irrigation. This valley is inclosed on three sides by foothills—on the north by Willow Creek range and on the southeast and south by the western termination of the Boise range. These hills rise to an elevation of 4,000 to 5,000 feet. The climatic conditions of the Boise Valley, as above stated, apply generally to this section. The rainfall is practically the same, as well as the mean temperature, but the growing season is a little earlier and somewhat milder.

The Payette River is the source of water supply for this valley. It has a drainage area of about 3,000 square miles above the irrigable section. The greater portion of the drainage basin is timbered, some of it heavily, and lies at an elevation of 5,000 to 6,000 feet. Many of the mountains of this drainage area are precipitous, but there are several wide valleys along the upper course of the river and on several of its tributaries. The snowfall is very heavy in the mountains, in some seasons exceeding 20 feet on the higher ridges. The North Fork of the Payette is fed by Payette lakes. These lie surrounded by well-timbered mountains at an elevation of about 5,000 feet. They can be cheaply converted into storage reservoirs if it is found that storage is necessary. The run-off of the stream, however, is remarkably uniform and has thus far been more than ample for the needs of the irrigators. The Emmett bench, lying in the Payette Valley, has recently been reclaimed by the Canyon Canal Company operating under the Carey Act, a fuller description of which is to be found elsewhere (see p. 51). It is also the intention of the Reclamation Service to carry on extensive operations in this section.

POWER DEVELOPMENT.

Although there are unlimited possibilities for the development of power within the State, the more remarkable opportunities are found on Snake River in the vicinity of Twin Falls. Immediately below the dam which forms the head of the Twin Falls North Side and the Twin Falls South Side irrigation systems the river enters a canyon bordered by vertical walls of lava many hundreds of feet in depth. In this canyon the river falls rapidly, partly in vertical

cataracts and partly in rapids. In a distance of 60 miles between Milner and the mouth of Malad River the Snake has a fall of about 1,500 feet, of which over one-half is in vertical drops of 50 to 200 feet each. The average low-water flow of the Snake at Milner, with the exception of the months of August and September, is over 5,000 cubic feet per second, and it is possible to supplement by storage the deficiency caused by diversions for irrigation in August and September, so that a uniform minimum flow of 5,000 cubic feet per second may be obtained throughout the year. Assuming that the entire flow of the river is diverted for irrigation in August and September, to maintain a minimum flow of 5,000 cubic feet per second below Milner 600,000 acre-feet of storage will be required.

The flow of the Snake between Milner and Malad River is augmented by the most remarkable underground flow of water in the world. From beneath the lava plains on the north of the river for a distance of over 30 miles the water pours out in great cataracts 100 to 200 feet above the river, and to an aggregate volume of about 4,500 cubic feet per second, practically doubling the average low-water flow of the river. This is pure spring water of an even temperature throughout the year, and mingling with the river so modifies the temperature of the latter as to prevent the formation of ice, to the great advantage of power development. A certain percentage of the water used for irrigation on the two large tracts of land bordering this section of the river and drained by it must escape into the river, increasing its flow to the extent of probably one-sixth of the 4,500 cubic feet per second diverted.

With a minimum flow of 5,000 cubic feet per second at the Milner dam, gradually increased, from the two sources described, to 9,000 cubic feet per second at Lower Salmon Falls, it will be possible to develop in this 60 miles of the river at average low water over 800,000 horsepower of electrical energy. If only the more favorable sites are utilized, including principally the vertical falls, nearly 500,000 horsepower can be generated. At Shoshone Falls alone 90,000 horsepower can be produced; at Twin Falls, 70,000 horsepower; at Auger Falls, 80,000 horsepower; at Upper Salmon Falls, 60,000 horsepower; and at Lower Salmon Falls, about 30,000 horsepower. In addition there are a number of lesser falls and the Malad and the Thousand Springs power sites. The process of actual power development in this canyon at the present time will be found in another place (see p. 45).

For a number of years the American Falls Power Company has been furnishing power and has a very excellent plant located at American Falls. About 5,000 horsepower has been developed up to the present, although the company has extensive plans for future development, which will ultimately reach 35,000 horsepower. At

Swan Falls, about 30 miles south of Boise, the Trade Dollar Consolidated Mining Company some years ago built a dam and thereby developed about 2,000 hydraulic and 1,200 electric horsepower. They have since increased their hydraulic development by 3,000 horsepower and their electric development by 2,000 horsepower, and 8,000 horsepower additional can be developed by the installation of the necessary machinery.

Another excellent power site is found in Washington County, at what is known as the "Ox Bow." At this point it is estimated that 30,000 horsepower can be developed.

In the northern part of the State there are excellent power sites. Power is being developed on the Pend d'Oreille and St. Joseph rivers, and on other streams in the interior of the mountainous section can be found many suitable sites for the production of power.

STREAM MEASUREMENTS.

The following table has been summarized from tabulations of measurements made in Idaho by the United States Geological Survey. This summary shows in a general way the drainage areas and the maximum and minimum discharges of the more important streams for the periods during which records have been kept.

Drainage areas and maximum and minimum discharges for 1895 to 1906.

River.	Place of measurement.	Drainage area.	Discharge in cubic feet per second.								
			Maximum.								
			1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	
Boise.....	Boise.....	Sq. miles.	2,450	7,095	40,132	24,652	6,535	17,567	11,960	12,668	8,188
Weiser.....	Weiser.....		1,670	3,095	17,940	16,765	3,875	6,580	6,770	7,137	7,340
Bear.....	Battle Creek.....		4,500	3,637	5,205	6,100	3,483	5,011	2,537	2,935	2,336
Snake.....	Minidoka.....		22,600	.....	53,100	45,560	26,360	39,220	.....	29,800	27,700
Do.....	Idaho Falls.....		10,100	250,450	54,300	.....	.....	.....	.....	22,711	25,269
Spokane.....	Spokane, Wash.....		4,005	.....	.....	.....	.....	.....	.....	.....	.....
Big Lost.....	Chilly.....		.....	.....	.....	.....	.....	.....	.....	.....	.....
Do.....	Mackay.....		.....	.....	.....	.....	.....	.....	.....	.....	.....
Blackfoot.....	Presto.....		1,016	.....	.....	.....	.....	.....	.....	.....	.....
Payette.....	Payette.....		3,565	15,015	28,260	25,570	.....	.....	.....	.....	.....
Bruneau.....	Grandview.....		1,800	1,101	3,630	3,840	1,040	2,452	.....	.....	.....
Portneuf.....	McCammon.....		500	.....	800	1,881	336	805	.....	.....	.....
Succor Creek.....	Homedale.....		.....	.....	.....	.....	.....	.....	.....	.....	.....
Big Wood.....	Gooding.....		2,190	2,360	1,290	2,390	.....	.....	3,625	.....	.....
Do.....	Bliss.....		.....	.....	.....	.....	.....	303	.....	.....	.....
Little Wood.....	Gooding.....		.....	.....	.....	.....	.....	.....	.....	.....	.....

a For 1890.

b For 1891.

Drainage areas and maximum and minimum discharges for 1895 to 1906—Con.

River.	Place of measurement.	Drainage area.	Discharge in cubic feet per second.								
			Maximum.				Minimum.				
			1903.	1904.	1905.	1906.	1895.	1896.	1897.	1898.	
Boise.....	Boise.....	Sq. miles.	2,450	16,750	19,680	6,260	8,720	830	830	940	698
Weiser.....	Weiser.....		1,670	10,410	11,620	.....	.....	35	200	80	30
Bear.....	Battle Creek.....		4,500	.....	.....	.....	.....	612	800	780	534
Snake.....	Minidoka.....		22,600	22,950	38,000	13,700	24,400	.....	4,875	4,900	4,300
Do.....	Idaho Falls.....		10,100	.....	.....	.....	.....	a2,900	b2,250	.....	.....
South Fork of Snake.....	Lyons.....		5,480	20,890	51,450	17,850	26,400	.....	.....	.....	.....
Do.....	Moran, Wyo.....		820	.....	7,930	4,990	5,928	.....	.....	.....	.....
North Fork of Snake.....	Ora.....		1,040	3,970	5,370	2,280	2,850	.....	.....	.....	.....
Teton.....	St. Anthony.....		960	3,075	5,385	1,755	4,020	.....	.....	.....	.....
Fall.....	Fremont.....		390	3,100	.....	2,712	2,587	.....	.....	.....	.....
Clarks Fork.....	Priest.....		.....	113,700	93,000	.....	.....	.....	.....	.....	.....
Priest.....	do.....		.....	8,760	6,770	.....	.....	.....	.....	.....	.....
Spokane.....	Spokane, Wash.....		4,005	.....	27,940	9,510	.....	.....	.....	.....	.....
Big Lost.....	Chilly.....		.....	.....	1,605	1,355	2,370	.....	.....	.....	.....
Do.....	Mackay.....		.....	.....	1,755	1,120	1,450	.....	.....	.....	.....
Blackfoot.....	Presto.....		1,016	350	.....	606	1,700	.....	.....	.....	.....
Payette.....	Payette.....		3,565	.....	.....	9,550	.....	975	1,255	.....	.....
Brunneau.....	Grandview.....		1,800	2,250	.....	.....	.....	15	45	35	15
Portneuf.....	McCammon.....		500	.....	.....	.....	.....	.....	.....	.....	80
Succor Creek.....	Homedale.....		.....	341	184	.....	525	.....	.....	.....	.....
Big Wood.....	Gooding.....		2,190	.....	.....	.....	.....	0	0	5	.....
Do.....	Gimlet.....		.....	.....	2,796	.....	.....	.....	.....	.....	.....
Do.....	Shoshone.....		.....	.....	.....	2,950	.....	.....	.....	.....	.....
Little Wood.....	Gooding.....		.....	1,050	548	.....	.....	.....	1	.....	.....

River.	Place of measurement.	Drainage area.	Discharge in cubic feet per second.								
			Minimum.								
			1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	
Boise.....	Boise.....	Sq. miles.	2,450	986	648	740	530	715	280	450	600
Weiser.....	Weiser.....		1,670	75	39	39	39	39	55	.....	.....
Bear.....	Battle Creek.....		4,500	597	455	400	302	.....	.....	.....	.....
Snake.....	Minidoka.....		22,600	4,950	2,000	.....	2,000	2,640	4,100	1,880	2,265
South Fork of Snake.....	Lyons.....		5,480	.....	.....	.....	.....	3,280	1,495	1,800	1,700
Do.....	Moran, Wyo.....		820	.....	.....	.....	.....	.....	390	374	374
North Fork of Snake.....	Ora.....		1,040	.....	.....	.....	.....	1,135	1,020	990	990
Teton.....	St. Anthony.....		960	.....	.....	.....	.....	550	365	253	180
Fall.....	Fremont.....		390	.....	.....	.....	.....	650	.....	168	365
Clarks Fork.....	Priest.....		.....	.....	.....	.....	.....	14,230	7,830	.....	.....
Priest.....	do.....		.....	.....	.....	.....	.....	820	845	.....	.....
Spokane.....	Spokane, Wash.....		4,005	.....	.....	.....	.....	.....	1,300	1,240	.....
Big Lost.....	Chilly.....		.....	.....	.....	.....	.....	73	65	.....	.....
Do.....	Mackay.....		.....	.....	.....	.....	.....	160	122	154	.....
Blackfoot.....	Presto.....		1,016	.....	.....	.....	.....	140	150	64	59
Payette.....	Payette.....		3,565	.....	.....	.....	.....	.....	.....	.....	c 805
Brunneau.....	Grandview.....		1,800	45	.....	.....	.....	40	.....	.....	.....
Portneuf.....	McCammon.....		500	85	.....	.....	.....	.....	.....	.....	.....
Succor Creek.....	Homedale.....		.....	.....	.....	.....	.....	0	0	.....	0
Big Wood.....	Gooding.....		2,190	.....	.....	.....	.....	.....	.....	.....	.....
Do.....	Bliss.....		.....	1,090	.....	.....	.....	.....	150	150	.....
Do.....	Gimlet.....		.....	.....	.....	.....	.....	.....	0	0	0
Do.....	Shoshone.....		.....	.....	.....	.....	.....	58	60	.....	0
Little Wood.....	Gooding.....		.....	5	.....	.....	.....	.....	.....	.....	.....

^a For 1890.^b For 1891.^c At Horseshoe Bend.

LANDS.

The classification of the lands of the State can only be approximated at this time. The lands have not been fully explored and surveyed, but the best estimate places the acreage as follows:

Agricultural lands, 11,000,000 acres; grazing lands, 20,000,000 acres; timbered lands, 20,000,000 acres; mineral lands, 6,000,000 acres.

AGRICULTURAL LANDS.

Of the agricultural lands, 6,000,000 acres are in the humid belt of the northern district of the State, lying along streams and in great sections of open prairie country, in which agriculture is carried on without the aid of irrigation. The soil in all this northern district of the State is exceedingly fertile, containing a large amount of vegetable mold of great depth and admirably fitting it for the production of all classes of agricultural crops. An eminent authority, describing the soil of this section of the State, uses the following language:

"An analysis of this soil shows it to be preeminently rich in all the mineral and vegetable elements necessary to the growth of all the cereals, vegetables, and fruits grown in the temperate zone."

About 5,000,000 acres lie in the irrigation belt of the southern district of the State, which is embraced within the great Snake River Valley and its tributaries. Of this great body of land over 2,000,000 acres is now covered by irrigation canals, of which about 1,000,000 acres is in a high state of cultivation. The uncultivated portion of this great body of land, that now lies under canals, is generally owned by residents of the land itself, many farmers owning 160 to 320 acres, of which 40 or 80 acres is under cultivation, the remainder of the holding being in an unimproved state. This uncultivated portion can generally be bought at a very reasonable figure. The character of the agricultural lands in this section of the State is especially desirable for irrigation. The native mountain soils have been enriched with a liberal quantity of volcanic ash and decomposed basaltic rock, the result being that the land is easily irrigated. It absorbs the water readily and retains the moisture a long time. In the Upper Snake River Valley, near St. Anthony, in Fremont County, are large tracts, composed almost wholly of decomposed volcanic rock and ash, which subirrigate. Surface irrigation is not practiced here at all. The land is not flooded as is general in irrigation sections. A farmer with 80 acres to irrigate constructs his ditches or laterals around the outside of the field, and may possibly put in one or two cross ditches. When it is desired to irrigate the ditches are filled with water and the land absorbs sufficient water to wet or moisten the soil over the entire field. This is a great advantage to the farmer, as the fields can easily be

kept clean of all weeds and foul plants, the surface never crusts or hardens, and plants of all kinds make a very vigorous and even growth.

GRAZING LAND.

The grazing lands of the State constitute by far the largest portion of its area. In the approximation given above the grazing and timber lands are equal, but a very large portion of the acreage classified as timbered is also grazing land and is occupied as a summer range by sheep and cattle. There are wide areas in the northern section of the State that are covered with rough hills and mountains, the south sides of which are valuable grazing land and the north sides heavily timbered. It is therefore safe to say that Idaho contains 30,000,000 acres of grazing land. A large portion of the land lying in the Snake River Valley of the southern district is suitable for winter grazing only. This land lies in dry plains, largely covered with a heavy growth of sagebrush and dry-land grasses, but without a supply of water for stock during the summer months. The melting snows and spring rains supply the needed moisture to produce a good growth of grass over all of this region, but the lack of water for stock saves the grass and forage until the snowfall of winter provides the needed moisture for cattle and sheep, and the grass then provides the winter feed for thousands of animals. During the summer months stock of all kinds seeks the green grass and pure spring water of the high mountain ranges with which the State is so liberally provided. Grass and forage in the mountains, when the snowfall is deep, grow rapidly and provide great quantities of feed year after year on the same range.

In central Idaho there are 14 species of indigenous and nutritious grasses, all differing in leaf, height, root, and seed top, but all furnishing valuable animal food and retaining vigorous vitality throughout the coldest winter weather. Nearly all of central and southern Idaho is covered with a heavy growth of no less than 6 different varieties of sagebrush, 4 of which furnish winter food for cattle, horses, sheep, elk, deer, sage hens, grouse, rabbits, and, in fact, all kinds of animal life that inhabit the country.

The snowfall is not great in this part of the State, seldom more than a few inches at a time, and during a good grass season and with a not overcrowded condition on the range stock of all kinds will winter well on the native grasses without being fed.

TIMBERED LAND.

The 20,000,000 acres of timbered lands comprise one of the chief sources of wealth in the State. This land is all located in the northern division of the State within the counties of Washington, Boise, Custer, Lemhi, Idaho, Nez Perce, Latah, Shoshone, Kootenai, and

Bonner. In Idaho, Bonner, Kootenai, Latah, and Shoshone counties is located the largest virgin forest of white pine timber in the world. This body of timber has attracted much attention among lumber men, and large bodies of it have been acquired by lumber syndicates, which are now making strenuous efforts to increase their holdings. The State owns some 300,000 acres of timber land that has been selected under the different grants made to the State by the Government at the time Statehood was attained, besides some 300,000 acres of common-school land, which lies within the timber belt; but this is a very small area compared to the millions of acres lying within the State. The class of timber is varied, yellow pine and fir predominating in some localities; in others are found spruce, tamarack, hemlock, and cedar; in another, the white pine; but the quality is pronounced by all conservative experts who have visited the forests to be as fine and as desirable as can be found anywhere. In the white pine district on the Clearwater River are found trees that are 5 feet in diameter and 100 feet to the first knot or limb of any kind, providing finishing lumber that can not be surpassed. In the forests that lie along the foothills of the Bitter Root Range, in the basin that is drained by the Clearwater River and its tributaries, are millions of acres of dense forests that have never been surveyed and are only slightly explored.

MINERAL LAND.

The entire western slope of the Rocky Mountains, which forms the eastern boundary of the State for a distance of more than 600 miles, is mineralized to a greater or less degree. Within this section are regions larger than the State of Massachusetts that have never been surveyed or prospected. At the points along the border of this region that are most accessible and convenient to transportation, discoveries have been made and development work is being opened and prepared for milling operations. Prospectors have made trips into the interior and returned with rich specimens of their finds, but the remoteness from transportation and the rough character of the country prevent the successful opening of the properties at this time.

Nearly all of the streams in the northern section of the State show placer gold in greater or less quantities, the deposits in many places being exceedingly rich. This is an indication to the prospectors that the waters of these streams at some points cut through ledges of mineral that contain this gold. In some places where prospecting for quartz ledges has been carried on the efforts have been crowned with success and valuable mines have been opened, but the efforts of the miners up to a comparatively recent date have been confined to placer discoveries and workings, as they are operated with little expense and the product is easily acquired and marketed. Trails and wagon

roads are being built that penetrate far into the mountain regions with a view to aiding the efforts of the prospector and miner in discovering and opening up this new country. The numerous streams that intersect all this mining country provide ample and cheap power for the development of the mines. The country is nearly all timbered, which provides this necessary item to every miner practically without expense.

NATIONAL FORESTS.

Within the State there are approximately 20,000,000 acres of land included in National Forests. The forests are in tracts varying in size from several thousand acres to over a million acres, and are administered by the Government through the Forest Service, of this Department.

The land embraced in the National Forests is the high, mountainous area of the State, covering the headwaters of the principal rivers, upon which the State depends for its water for irrigation and other purposes. All of this land is not forested, a part being covered only by chaparral and sagebrush, and is valuable only for grazing, mining, and watershed protection. In the withdrawal of this land it was impossible to make the boundaries of the Forests conform to the forest land and the watersheds; consequently, in the small high valleys some lands suitable for agriculture were included. However, under the act of June 11, 1906, such land inside a National Forest which is valuable for agriculture can be located and a patent obtained under the homestead law. Upon application the Forest Service will survey such land free of charge and issue a special-use permit for the occupancy and cultivation of the land pending its listing by the Secretary of the Interior.

The three principal lines of work on the National Forests are timber sales, grazing, and special use. Settlers in and around the Forests are allowed timber for their ranches and homes free of charge, but where timber in large amounts is desired it is sold in the open market by competitive bidding. In every case timber must be thoroughly utilized and not wasted. It must also be cut under conservative methods, in order that a forest cover be left for future supply and to protect the watersheds. Timber which is mature and which can safely be cut is always for sale. The range is allotted, each grazer being given a district upon which, by paying the required grazing fee, he is entitled to graze his stock. In the allotment of the range the settler who owns a ranch is first provided with range, after which the outside owners are given allotments. It is the object of the Government to allow only the number of sheep on the range which it

will support without injury to the forage. Last season approximately 2,000,000 sheep were grazed on the National Forests in Idaho.

Under special-use permits the use of land in the forests is allowed for any other purposes, such as pastures, power plants, reservoirs, hotels, roads, and telephone lines. Where such privileges are of local benefit and not of a commercial nature no charge is made. In the case of mining, the Government imposes no restrictions inside the National Forests. Prospectors and miners are free to explore wherever they please and can perfect title to their claims upon the finding of mineral in paying quantities. They are given timber free of charge so long as it is not put to commercial use and can use the timber on their claims for their development.

SCHOOL LAND.

In the State of Idaho, sections 16 and 36 are known as school sections and belong to the State. Where these sections are covered by National Forests the State may at its option select other lands either within or outside the forest boundaries in lieu of these sections.

According to the law, 25 per cent of the receipts from the National Forests goes to the States in which the forests are located. During the year ended June 30, 1908, the State of Idaho received \$56,307.84 as its share of the proceeds from the forest lands within its boundaries. This money is spent by the various counties in the improvement of its roads and public schools. In addition to this amount the Forest Service spent a large amount on improvements in the National Forests. These improvements consisted of the construction of roads, bridges, telephone lines, trails, etc., all of which tend to open up the country and bring the mountain settlers into more direct and feasible communication with the outside world.

IRRIGATED AND IRRIGABLE LANDS.

The latest figures covering the land actually irrigated and the lands which are irrigable are given in the following table:

Irrigated and irrigable lands.

Counties.	Irrigable lands.	Irrigated lands.	Counties.	Irrigable lands.	Irrigated lands.
Ada.....	<i>Acres.</i> 235,267	<i>Acres.</i> 135,000	Kootenai, partly by rain	<i>Acres.</i> 88,012	<i>Acres.</i> 57,000
Bannock.....	339,978	197,000	Latah, by rain.....	187,000	112,000
Bear Lake.....	62,163	46,000	Lemhi.....	58,356	36,000
Bingham.....	478,215	302,000	Lincoln.....	464,000	170,000
Blaine.....	193,150	125,000	Nez Perce, partly by rain.....	133,000	97,000
Boise.....	41,634	30,000	Oneida.....	83,689	63,000
Bonner, partly by rain.....	95,000	64,000	Owyhee.....	1,328,000	210,000
Canyon.....	302,580	173,000	Shoshone, partly by rain.....	2,500	1,400
Cassia.....	125,000	74,000	Twin Falls.....	279,000	157,000
Custer.....	125,000	67,000	Washington.....	151,172	87,000
Elmore.....	129,606	79,000	Total.....	5,444,619	2,663,400
Fremont.....	537,285	378,000			
Idaho.....	5,012	3,000			

PRODUCTS OF IRRIGATED LAND.

During the past few years Idaho has made remarkable strides in irrigation development along the line of agricultural and horticultural products. The yield of cereals to the acre in Idaho is nearly double the average yield of the United States. The future of the agricultural industry in this State is very promising. The farmers as a class are intelligent and employ modern methods for carrying on their work, and are surrounding themselves with all the conveniences for making life pleasant.

In southern Idaho, throughout the Snake River Valley and its tributaries, all of the land requires irrigation. In the northern counties of the State—Idaho, Nez Perce, Latah, Shoshone, Bonner, and Kootenai—irrigation is not required or employed in farming, excepting in some cases where fruits and vineyards are grown on the sandy bars along the rivers.

In the irrigated region fully 4,000,000 acres are now covered by irrigation canals, and the lands served by these canals are nearly all owned by the people who occupy them. Experience has shown that in this region the greatest profits accrue from small farms under intensive cultivation. With care and attention the land will produce twice as much, support double the population, and become twice as valuable per acre as it would if the larger holdings were the rule. There are, however, a great many large farms in the irrigated district, some of 160, 320, and even 640 acres, successfully farmed, and large profits are realized by their owners. These large farms are often devoted to growing alfalfa for hay, and it is not unusual for these farmers to cut 1,000 to 2,000 tons.

Within the humid belt of the northern part of the State the conditions are different. Land is owned in larger bodies and farming is carried on in a very different manner. Wheat, oats, and barley are the principal crops grown in this region, and until within the past few years it was believed that nothing but grain could be grown throughout Idaho, Nez Perce, and Latah counties, but experience has taught differently. Alfalfa and clover produce two good crops a year and make a large growth for pasture besides. All varieties of pasture grasses grow well. It has been shown that the farmers can add stock growing, especially sheep and hogs, to their grain-raising industry with great profit. The sheep and hogs are raised on the grass pastures and fattened on the stubble fields after the grain has been removed. It has been learned also that fruits of all kinds will thrive here, and some of the finest and most promising orchards to be found within the State are in Nez Perce and Latah counties.

While the agricultural conditions in the humid and the irrigated sections of the State are entirely different, it is a noticeable fact that the industry in all sections is very promising.

RESULTS AT THE TWIN FALLS EXPERIMENT STATIONS.

A very fair idea of results possible under irrigation in Idaho can be obtained from a perusal of the third annual report of Mr. Alexander McPherson, director of experiment stations for the Twin Falls North Side Land and Water Company and the Twin Falls Salmon River Land and Water Company, from which the following figures are taken. The conditions met with upon the experimental farm in question are generally such as would be encountered anywhere in southern Idaho, so that the results of the experiments are generally applicable to southern Idaho and are not to be construed as applying particularly to the Twin Falls tract. Report of the yields of different crops raised on the farm for 1907, according to Mr. McPherson, are given in the following table:

Crop yields at Twin Falls experiment station.

Crop.	Size of field.	Yield.	Yield per acre.
Alfalfa.....	14.5 acres.....	101 tons.....	7 tons.
Potatoes.....	5.5 acres.....	72,000 pounds.....	218 bushels.
Wheat (Dicklave).....	1.0 acre.....	72 bushels.....	72 bushels.
Oats (Big Four).....	1.0 acre.....	107 bushels.....	107 bushels.
Carrots.....	6,739 square feet.....	4 tons.....	25.4 tons.
Sugar beets.....	6,739 square feet.....	6,810 pounds.....	22 tons.
Corn:			
White Dent.....	15,900 square feet.....	789 pounds.....	
Early Minnesota.....	15,900 square feet.....	1,500 pounds.....	
Flint.....	17,580 square feet.....	1,500 pounds.....	
Windus.....	13,478 square feet.....	885 pounds.....	

POTATOES.

Eight varieties of potatoes were planted, and, while the yield was not as large as expected, the tubers were of extra-fine quality and brought a good price in the market. The Burbanks and Early Ohios were the best yielders, the Eureka and Six Weeks the best early potatoes, while the Pearl and Peerless did not yield so well. The Early Rose yielded well, and were good, clean, even-sized potatoes. Perhaps the most promising variety was the Netted Gem, giving a large yield of fine quality even-sized potatoes.

The ground was quite dry on the surface when the potatoes were planted. The planting was done with horse planters, and they were not planted as deep as they should have been. It is probable that at least a third better crop would have resulted from a little irrigation before planting. In that portion of the field which was irrigated

only once, the plat having been irrigated before planting, the best crop was produced. The potatoes were cultivated frequently, and the ridging system was followed. In each cultivation the ridges were made larger until the end of the season. No hand work was done. The average yield was 218 bushels per acre, while on 1 acre which was irrigated before planting the yield was double that amount.

WHEAT AND OATS.

The oats yielded 107 bushels per acre and the wheat 72 bushels. The seed oats were not disinfected before planting, as there was no evidence of smut visible on the seed. When the crop matured, fully 15 per cent of the grain was ruined by smut. This shows the necessity of disinfecting all grain before planting. The wheat was of a fine quality and free from smut.

CARROTS.

The yield of carrots was very satisfactory—at the rate of over 25 tons to the acre. This makes carrots a very profitable crop, as they are a valuable feed for all kinds of stock.

CORN.

Four varieties of corn were grown. The yield was 36 to 68.5 bushels to the acre. Three of these varieties have been grown on the Twin Falls experimental farm for three successive years and are now acclimated. While the yield was not so large as last year, it was of better quality and matured in good season long before any danger of frost. No special attention was given to corn this year other than ordinary farmer's care, and the spring, too, was very backward, yet a very satisfactory crop was harvested.

The growing of corn on the Twin Falls tract can no longer be called an experiment, as it has been thoroughly demonstrated from three years of trial that corn of fine quality and a large yield can be raised. It was demonstrated on the farm last year that hogs, alfalfa, and corn made a fine combination for profit. It may be said that the hog industry is one of the paying adjuncts to the farm, while the results of dairying prove immensely profitable.

SUGAR BEETS.

During the last few years a new industry has taken on large proportions in Idaho, namely that of sugar-beet culture. The beet crop is thoroughly adapted to most of the irrigated districts of the West and is found to be very profitable to the farmer, since there is a ready

market for his crop at a stipulated price. Four large sugar factories have been built in the State within the past five years—one each at Sugar, Idaho Falls, Nampa, and Blackfoot. The Utah-Idaho Sugar Company, the owner of these factories, keeps an experienced corps of field men who confer with the farmers weekly, advising them relative to the selection of their soil, the preparation of the same, and the raising and harvesting of the crop. In this manner most excellent results have been attained, one of which is more intensive farming.

It has been found that the best results are obtained by plowing as deep as the condition of the soil will permit, after which a subsoiler is used in order to loosen at least 12 inches of earth. During the growing season, between the different irrigations, the beets are subjected to intensive cultivation until the tops have become large enough to shade the ground. By following this method much less water is required for irrigation than was formerly needed on such lands. For the reason that the stirring of the soil helps to retain the moisture and by permitting it to reach a greater depth, there is much less evaporation.

The farmers are also learning the benefits of keeping the soil well fertilized by plowing under a crop of alfalfa or clover, by putting barnyard manure upon the soil, and by feeding cattle or sheep upon the ground, allowing them to bed upon the land. This should be allowed, however, only when the soil is dry during the winter season. By following these methods exceedingly fine results may be obtained, and it is not unusual to harvest 15 to 20 tons per acre from suitable lands under systematic culture. There is a large acreage of land within the State well adapted to the growing of sugar beets, and the industry, now in its infancy, bids fair to become very general.

Practical irrigators are beginning to appreciate the advantage of rotation of crops, such as alfalfa, or clover, grain, and sugar beets, together with other cultivated crops for increasing the fertility of the soil. Better markets are also furnished where diversified crops are raised than where but one cereal is planted year after year.

RECENT IRRIGATION DEVELOPMENT.

As stated before, during the past five years there has been remarkable development in irrigation throughout the State. This development has been due chiefly to two causes—governmental aid through the Reclamation Service, and the large investment of private capital under the provisions of the Carey Act. Private capital has also been instrumental in developing good projects without proceeding under this act.

THE RECLAMATION SERVICE.

The projects now under construction in Idaho by the Reclamation Service are the Minidoka, situated in the central portion of the Snake River Valley, and the Payette-Boise, in the valley bearing these names, situated in the southwestern part of the State.

MINIDOKA PROJECT.

The Minidoka project contemplates the reclamation of about 80,000 acres by a gravity system of canals, which are practically completed at the present time; 50,000 to 70,000 acres of land situated above the gravity canals will be reclaimed by a pumping system now in process of construction. These lands lie in Lincoln and Cassia counties, in townships 8 and 10 south, in ranges 20 and 25 east, Boise Meridian. The water necessary for the irrigation of these tracts is diverted from the Snake River at a point 6 miles south of Minidoka. The diversion works consist of a rock-filled dam with a gravel and earth back-filling 56 to 80 feet high and 600 feet long between abutments, a masonry spillway 2,500 feet long, over which the surplus water flows, and a diversion channel excavated around one end of the dam, closed by a masonry dam with five regulating gates. Provision is made in the diversion channel for the installation of a power house. The water needed for the irrigation of the Twin Falls system will be available at this point for the development of power. When a full supply is provided for the irrigation of the Twin Falls tract about 30,000 horsepower can be developed at this dam. The South Side Canal diverts at a point near the south end of the spillway and will irrigate by gravity about 8,000 acres. Provision has been made in its location and construction for its future enlargement to a capacity of 800 cubic feet per second. The North Side Canal diverts at a point about 100 feet north of the diversion channel and will irrigate 72,000 acres of land situated on the north side of Snake River. The main canals and branches and its tributaries have a total length of about 300 miles.

The soil of the tract is a sandy loam of high productive power under irrigation. The average elevation above sea level is 4,200 feet. The temperature ranges from about 12° to 96° F. above zero, the mean temperature being about 45° F. The average rainfall is about 15 to 20 inches. The principal products are alfalfa, sugar beets, cereals, vegetables, and fruits. Two or three crops of alfalfa are cut each year.

Under the regulations of the Service the lands can be homesteaded in units of 40 to 80 acres, according to location. Good markets are found in Rupert, Heyburn, Burley, and at the mines located in the neighboring territory. The value of irrigated land varies from \$50

to \$100 per acre. These values will undoubtedly advance with the demand, which is constantly increasing for land in this section. The Minidoka and Southwestern Railroad, connecting with the Oregon Short Line at Minidoka, passes through the tract, giving easy access to foreign markets. Homestead entries for this tract are made at the United States Land Office in Hailey.

The sixth annual report of the Reclamation Service showed the following use of water on the project on June 30, 1907:

Farm units for which water was available June 30, 1907-----	950
Water-right applications filed prior to June 30, 1907-----	755
Farm units prepared for irrigation June 30, 1907-----	516
Farm units prepared and receiving water on June 30, 1907-----	474
Farm units prepared and not receiving water on June 30, 1907-----	42
Farm units not prepared for irrigation-----	695
Area irrigable under present system, high tracts deducted-----acres	74,880
Total farm units under present gravity system-----	1,211
Area in cultivation in 1907-----acres	18,192
Area actually irrigated, estimated-----do	15,000
Farm units containing cultivated land-----	737
Area in cultivation-----per cent	25

PAYETTE-BOISE PROJECT.

The Payette-Boise project, as approved in its entirety, provides for the reclamation of 372,000 acres, mostly situated in the Boise Valley. Water will be taken from the Payette and Boise rivers and storage systems will be constructed on the headwaters of these streams. The works for the first division of this project are now under construction and nearing completion. They include a masonry dam in the Boise River and a main canal about 40 miles in length from the Boise River to Deer Flat Reservoir and two reservoir embankments. These works will provide for the reclamation of 120,000 to 150,000 acres on the south side of the Boise River.

Other divisions of the project provide for the construction of storage reservoirs on the headwaters of the Boise River and enlarging and extending the main canal, the construction of the canal on the north side of Boise River, a storage reservoir at Payette Lake, a dam in the Payette River, and a canal leading from the same through a ridge into the Boise Valley. This system of canals will carry the early flood water for the irrigation of about 300,000 acres now in desert condition, and the reservoirs will hold nearly enough for the late irrigation for practically all of this area.

About three-fourths of the land under the project is in private ownership, the remainder belonging to the United States and the State of Idaho. It is all of good quality, the soil being a light, sandy

loam, and when reclaimed will have a value of \$75 to \$150 per acre. These lands lie in Ada, Canyon, and Owyhee counties, in townships 1 to 10 north, in ranges 2 east to 5 west, Boise meridian. The altitude ranges from 2,250 to 2,800 feet, while the temperature ranges from 104° to 9° F. above zero, with a mean of about 56.6° F. The average rainfall is 14.5 inches per year. The soil is excellently adapted to the raising of alfalfa, sugar beets, cereals, and fruits of all kinds. The apple and prune orchards of this district are quite profitable, the fruit finding ready market on the Atlantic seaboard and in Europe. The quality of cantaloupes grown in certain sections is equal to that of the famous Rockyford product. Two crops of strawberries are raised each year, that fruit being gathered as late as the middle of November. The second crop is, if anything, of better quality than the first. The local and western markets are Payette, Nampa, Boise, Meridian, Caldwell, and Portland, Oreg., while, as stated above, a great deal of the fruit is shipped to New York and across the Atlantic.

A great deal of the land under the project is in private ownership and has been for many years. As a result there is a number of good towns, of which Boise, the capital of the State, is the largest. A most excellent public-school system is maintained, and there are many churches having large and growing memberships. The steam transportation facilities of this section consist of the Oregon Short Line; the Boise, Nampa, and Oregon, and the Idaho Northern Railway. Interurban electrical transportation has developed rapidly during the last two years, one line now connecting Boise with Caldwell, 32 miles away, while another will shortly reach Nampa. The rural districts are amply covered with telephone lines and are kept in touch with the outside world by means of the rural free delivery of mails.

IRRIGATION DISTRICTS.

The seventh session of the legislature (1903) passed an act known as the "irrigation district law,"^a whereby water users are enabled to own and control their own irrigation works under a system of municipal government. The act of 1903 was intended to replace a similar act passed in 1895 and amended in 1897, 1899, and 1901.

After an irrigation district has been duly organized it has authority to issue bonds and create liens upon the land within the district to secure the ultimate payment of the bonded debt. Payment of the bonds being thus secured, there is always a good market for such securities.

The first district to be organized under the irrigation-district law was the New Sweden irrigation district, the organization of which

^a H. B. 112, seventh session laws, p. 105.

was effected in 1899. For the purpose of irrigating about 16,000 acres within the limits of the district the Great Western and Porter canals were purchased, diverting water from Snake River. The former canal is 26 miles long and has a capacity of 200 cubic feet per second.

At the time of the latest report of the secretary of the district, in 1906, a total acreage of 16,178 acres had been assessed at 80 cents per acre, 50 cents for the general fund and 30 cents for bonded fund. During the season 15,068 miner's inches of water had been furnished at 15 cents per inch, while a little over 1,000 inches of water was furnished for lands outside the district at \$1 per inch.

The total assets of the district in January, 1906, amounted to \$190,623.79. The liabilities of the district were \$80,674.75, leaving \$109,949.04 as the total net assets.

The organization of the Pioneer irrigation district was effected in 1901, its purpose being the irrigation of 36,500 acres in Canyon County. To carry out the object of the organization the Phyllis and Caldwell canals were purchased. The former is 37 miles long and has a capacity of 550 cubic feet per second; the latter is 20 miles long and carries 70 cubic feet per second. The latest report of this district, which was made in 1906, showed assets of \$312,694.83 as against liabilities of \$302,102.32, leaving net assets of \$10,592.51.

For the purpose of irrigating 32,000 acres of land in Oneida County, the Oneida irrigation district was organized in 1902. The source of water supply is Mink Creek, the water being conveyed through Mink Creek Canal, which is 59 miles long and has a capacity of 300 cubic feet per second. This district in 1906 had issued \$526,000 worth of bonds and had expended \$500,000 of that amount. The number of acres bonded in the district was 31,000, and the cost of water per acre amounted to \$18.45.

The Weiser irrigation district was organized in 1902, for the purpose of taking water from the Weiser River through its own canal, 17 miles long, with a capacity of 160 cubic feet per second for the irrigation of 9,000 acres in Washington County. In 1906 the tax levy was 70 cents per inch for water, 45 cents per inch for interest on bonds, and 35 cents per inch for improvements. The total assets of the district in 1906 were \$66,319.40, as against liabilities of \$60,337.45, leaving net assets of \$5,981.95.

The first steps toward the organization of the Montpelier irrigation district were taken in 1903. It was not, however, until 1905 that the district was ready to proceed to the issue of bonds. This district was organized for the purpose of constructing a canal to irrigate about 10,000 acres lying between the towns of Montpelier and Bennington, in Bear Lake County, the source of supply being Bear

River. The cost of the diversion works was estimated at a little more than \$98,000.

In 1904 the State engineer of Idaho rendered a report to the board of directors of the Nampa and Meridian irrigation district, approving the general plan which had been formulated by the board.

This plan contemplated the purchase of the canal system known as the "Ridenbaugh Canal system," situated in Ada and Canyon counties. The main canal has a capacity of 400 cubic feet per second and is about 50 miles long. The system also includes 10 main laterals with a combined length of about 60 miles. At the time of the above-mentioned report the total acreage of the proposed district was approximately 79,000 acres, of which 23,600 acres were then under cultivation.

E. H. Dewey, chairman of the board of directors of the district, in making his biennial report to the State engineer in 1906, gave comparative figures showing the difference between district management as against private ownership. This comparison is of interest for the reason that it demonstrates the benefits to be derived by communities availing themselves of the provisions of the irrigation district laws.

For the purpose of maintenance and operation of the canal system a toll of \$1 per inch was levied in the spring of 1906. It seems quite certain that this will be amply sufficient to completely cover that expense.

The annual interest for the bonds outstanding amounts to 99 cents per inch of water, which is 6 per cent on \$16.50, the cost per inch of the existing water system. It seems quite clear that the total expense annually to be incurred hereafter for maintenance and operation, together with the interest on the bonds, will not exceed \$1.99. This means that where land has five-eighths inch per acre the annual cost per acre will approximate \$1.25. Of course where parties have acquired and hold larger amounts per acre the cost will be increased correspondingly, a full inch per acre costing \$1.99 per annum. We have been compelled to make the tax levy for the interest on the bonds for the year 1906 large enough to pay the interest on the bonds for two months in the year 1905, the bonds having been issued November 1, 1905, and bearing interest from that date. We therefore deemed it wise to make the interest levy for this year 8 per cent on the bond issue of \$16.50 per inch of water, making a levy of \$1.32 per inch, a total for interest and maintenance of \$2.32 for 1906, or, estimating the duty of water at five-eighths inch per acre, a total expense of \$1.45 per acre. As stated, however, this levy will be 2 per cent, or 33 cents, less hereafter.

Comparing these results with the former management, it appears that while the rate charged by the former owner of the canal has been only \$1.65 per inch of water, yet it required the whole of this sum to maintain and operate the canal, the owners of the canal permitting the taxes and interest on its bond issue to default for a series of years.

We are therefore pleased to report that the plan of irrigation formulated under the provisions of this act is being successfully carried out.

The Settlers irrigation district was organized for the purpose of more economically irrigating about 11,000 acres lying south of Boise

River in township 4 north, range 1 west, and township 4 north, range 1 east of Boise meridian, the water to be diverted from Boise River through the Settlers Canal, built some years ago by private parties.

Several other districts are in process of organization. The experience of the districts already in operation has demonstrated most satisfactory results.

IRRIGATION IN NORTHERN IDAHO.

The Spokane River Valley extends 30 miles east of the city of Spokane, the eastern 15 miles being within the State of Idaho. This does not mean that half of the lands of the valley is in Idaho and half in Washington, for the valley is somewhat the shape of a fan, with the narrow end toward the city, and gradually widening out until at the State line it is about 5 miles wide, while at the eastern end of the valley it is 15 miles in width. In this eastern part of the valley irrigation was begun in northern Idaho. Almost surrounded by lofty mountains, the valley land lies as level as an irrigator would wish, having sufficient fall to make it possible to reach large bodies of land with single laterals. From an elevation of 2,400 feet in the northeastern part of the valley there is a gradual fall to 2,000 feet elevation at the State line on the west. Within the bordering mountains are located several large lakes, where the melting snows and spring and fall rains are held in check ready to be drawn off and distributed over the lands of the valley when the dryness of the summer months demands.

WATER SUPPLIES.

In the year 1900 an irrigation company secured the rights by appropriation of Bucker Lake, Fish Lake, Spirit Lake, Hayden Lake, and the Spokane River in Idaho, and also the rights of Liberty Lake and Newman Lake, in Washington, up to their storage capacity. Plans were made for the development of these water supplies into one large system which would ultimately cover the entire valley. Work was begun upon the Liberty Lake supply on account of its being easier of development than the others. In 1901 some land was irrigated from this supply. The district covered was called Green-acres, and the entire body of land to be irrigated was given the name of "Greenacres Irrigation District."

The Liberty Lake water supply is considered to be adequate for watering 1,000 acres. To do this it is only necessary to hold in the lake the water which usually runs off in the early spring, thus keeping the water in the lake up nearly to the high-water mark until the beginning of the time when water is needed in the valley. Settlers

were slow to take hold of the new proposition at Greenacres, until after two crops had been raised showing results in produce far beyond the expectations of even the members of the irrigation company. Some of this first land sold as low as \$60 per acre, on easy terms, and has since sold as high as \$1,200 per acre, with no improvements but growing trees and crops between them.

Thus encouraged, work was begun upon the larger development of the Fish Lake water supply, which was estimated to be sufficient for the watering of 5,000 acres. Work was begun upon canals and head-works in 1903. A large canal was built from Fish Lake Creek, near Rathdrum, to convey the water to a fine-lying body of land 4 miles southwest of Rathdrum and extending from the northern boundary of the valley clear across to the Spokane River on the south.

EAST GREENACRES.

Soil.—The soil of the land of East Greenacres, watered by the Fish Lake Canal, is composed of very rich vegetable mold and decomposed granite mixed somewhat with coarse gravel. There was at first a prejudice against the soil on account of the gravel, but analysis shows that the soil with the gravel is of unusual richness, and experience has taught that by retaining the heat through the cool nights the gravel tends to make a warmer and quicker soil, thus making possible the early ripening of tomatoes, melons, sweet corn, berries, and similar crops which would otherwise be too late to be profitable.

Products.—The needs of the near-by city of Spokane, with its 70,000 population, and the near-by mining and timber sections in Idaho, and the wheat-raising country of the Palouse Valley, for vegetables, berries, fruits, dairy and poultry products, give opportunity for excellent returns upon that class of farming. The few spots in the near-by valleys where it was possible to raise paying crops without irrigation had long been developed and could do little to supply the demand. Thus the returns received by the first settlers of Greenacres and East Greenacres were such as to attract and encourage many settlers in locating on the new lands opened up by these water supplies. The table below gives some idea of the variety of crops raised, the yields, and the net returns on lands at Greenacres and East Greenacres. This was compiled from statements of farmers in that vicinity for the year 1907.

Yields and returns from crops at Greenacres.

Name of owner.	Area.	Kind of crop.	Yield per acre.	Total value.	Price of produce.	Estimated value of land.
S. D. Brown.....	1.00	Strawberries.....		\$570	\$2-\$3 per crate.....	
Justine Clark.....	.75	Dewberries.....		670	\$2.50-\$3.50 per crate.....	\$500
Charles Taylor.....		Tomatoes.....	20 tons.....		\$0.35-\$1.50 per 20 pounds; \$8-\$12 per ton.	
W. G. Cook.....	.25	Onions.....	70 sacks.....	105	\$1.20 per cwt.....	
Theo. Ephing.....	1.50	Potatoes.....		155		
C. Zimmerman.....	6.00	(Table beets ^a		160		
T. W. Jorden.....	.25	Potatoes.....	225 sacks.....		\$1 per cwt.....	350
A. M. Richardson.....		Cauliflower.....		112		
		Potatoes.....	250 sacks.....		\$1 per cwt.....	

^a Grown on same land after potatoes were gathered.

These returns are upon crops of vegetables and berries raised between the fruit trees while they are growing into fruitage. The orchards are too young to give definite returns per acre, but even the 3-year-old trees have shown the abundance of the crop that can be expected, and the quality, especially of the winter apples, is pronounced by expert fruitmen to be equal to the older fruit sections of the Northwest. It is safe to say that bearing orchards of the right varieties of fruit will justify values of \$1,000 to \$2,000 per acre. The crops between the trees have already made valuations of \$350 to \$600 per acre, and in nearly all cases the growing trees have increased in value from \$100 to \$150 per acre each year from the time of planting, and the resales which have been made have substantiated the increases.

Climate.—The winters of the valley are mild, with only an occasional spell of zero weather. Planting begins in April and harvesting of berries in July and August. Tomatoes ripen in August and continue to bear into November. The latter part of July, all of August, and part of September are the hot, dry days when the irrigation is most necessary. The rainfall, of about 18 inches, comes mostly in the early spring and late fall.

The calendar or rotation system is found to be most successful, and is so managed that a man with 10 acres can water his entire tract thoroughly in twenty-four hours, the watering being equal to 2 to 2.5 inches of rainfall. This wets the soil to a depth of 3 or more feet and makes any further watering unnecessary for ten days to two weeks.

Five or six irrigations during the entire season are found to be most successful, and the amount of water used is equal to flooding the land to a depth of 10 to 15 inches. A gravity system with a storage reservoir, so that the supply can be increased or diminished according to the needs of the dry season, is found to be necessary for this character of soil on account of its porous nature.

Value of land.—The land of East Greenacres, subject to a perpetual water right, is now being sold at \$200 per acre, payable one-fifth cash and the balance in four annual payments, with interest on the deferred payments at 7 per cent per annum. The improved places that are being sold range from \$300 to \$1,000 per acre, according to the age of the trees. There is little doubt that this district will become one of the best fruit districts in the Northwest, and the present low prices of land are due to the newness of the country.

Advantages.—In addition to the excellent earning ability of the land on account of productiveness of soil and nearness to market, these lands have the additional advantage of offering a location for a home in a very beautiful valley where the facilities for all conveniences are far ahead of most irrigated countries. Instead of a surrounding barren desert, East Greenacres district consists of very picturesque timbered mountains, at the foot of which are numerous lakes within easy access of the settlers. The convenience of the city is brought within close proximity to the district by an electric railroad, the Coeur d'Alene and Spokane Railroad, and by the Northern Pacific, the Idaho and Washington Northern, and the Spokane International railroads, all of which traverse the district and have stations at convenient points. These are of inestimable value to the settlers, both from a shipping standpoint and on account of making the advantages of the city and the lakes and near-by towns easily attainable. Fine graded schools on the ground and the city high school within a few minutes' ride on the electric line give the best opportunities for the development of higher education of the farmers' families. Spokane's churches, as well as those of Rathdrum, Post Falls, and Coeur d'Alene, added to those located in the irrigation district, give every denomination the privilege of attending the worship of their choice. Public libraries, theaters, lecture rooms, department stores, and the like are all within reach of the settlers. Retired preachers, lawyers, merchants, business men, doctors, mechanics, and others are able to find in the valley profitable employment of their time in fruit raising without the deprivations which so often accompany farm life. Such men as well as farmers are on the list of contented settlers upon the irrigated lands of the Greenacres irrigation district.

IRRIGATION NEAR LEWISTON.

A number of years ago an irrigation company began operations in the vicinity of Lewiston. This company will ultimately irrigate approximately 20,000 acres. Thus far it has furnished water for only about 4,000 acres. The lands of this company lie adjacent to the city of Lewiston, Idaho, and were capable of producing wheat without irrigation, but under irrigation are especially adapted to

fruit growing and gardening and produce easily from \$150 to \$1,000 per acre per year in vegetables and fruits. The lands are subdivided into 5-acre tracts and are watered by means of a pipe system, all conduits being underground and the water furnished under pressure for domestic and irrigation use.

Owing to the very high productive quality of the land the district is comparatively thickly settled for a farming community, and on account of the proximity of the lands to the city of Lewiston the residents on the orchard tracts have many conveniences—such as telephones, electric lights, and grocery deliveries, besides the educational and social advantages of the city.

The chief vegetables grown are onions, potatoes, turnips, carrots, and beans, besides garden truck. Considerable money is made out of melons and small fruits, but by far the greater part of the land is planted to peaches, apples, cherries, apricots, and California and European grapes, besides some almonds, English walnuts, and other fruits.

The plant of the irrigation company has been pronounced by engineers to be one of the most highly developed in the West in point of general efficiency. The water is stored in a large reservoir, whence it is conducted by underground pipes and distributed from the alley, which runs at the back of each lot, through a 3-inch pipe into each 5-acre tract. The pressure at every lot is 50 to 100 feet head, and it has been found that there is a very great saving in time and labor, when delivered under pressure, in supplying water for irrigation in such quantities that each consumer may take his portion of his season's supply at any time he desires. This pressure is also sufficient to permit the consumer to pipe his home and, further, use the water for fire protection; and as there are no open ditches there is no malaria and no mosquitoes.

CAREY ACT PROJECTS.

The act of Congress known as the Carey Act was passed August 18, 1894, and provided, in substance, that there should be granted to the States in the arid country 1,000,000 acres of land to each State, providing the State should cause the same to be irrigated, reclaimed, and occupied within ten years after the passage of the act. This ten-year limitation which the first act of Congress contained was a serious drawback to irrigation development. The plan was new, and as investments in irrigation enterprises had generally been unprofitable and the purpose of the act was not thoroughly understood, the States generally did not enact suitable legislation to put it in force.

In June, 1896, a very vital feature was added, which provided that a lien might be created on the land by the State for the expense of

reclamation. This was a most important feature of the law, since it gave the security to the investor which up to that time had been lacking. The ten-year limitation, however, still remained. This was removed in March, 1901, so as to provide a period of ten years' time upon each project. This period of time was generally considered amply adequate, and from that date these acts, which together are generally called the "Carey Act," have been a most effective agent in the upbuilding of the State.

The legislature of the State of Idaho in 1895 provided for the acceptance of the act of Congress and passed a law providing that persons desiring to build irrigation works under the provisions of this law should present their proposals to the State board of land commissioners, describing the character of works to be built, the nature of the water rights, the water supply, and specifying the price and terms at which water rights were to be sold. Under the law this application is referred for examination to the State engineer, whose duty it is to report upon the water supply, water rights, the character of the land, and the feasibility of the project generally. After the making of the report by the State engineer, the State board of land commissioners either rejects or accepts the application, and in case of acceptance, it appoints a State agent to select and segregate the land. The various papers required by the regulations are forwarded to the Department of the Interior, and when these are approved a contract is entered into between the State and the United States providing for the conveyance of the land to the State when an ample supply of water is actually furnished in a substantial ditch or canal to reclaim the land. When the works are constructed a patent is issued to the State, without regard to settlement of the land. When work is actually commenced and the State land board is satisfied as to the soundness of the project, the land under the State law is thrown open for entry. No settlement, however, is required at this time. When the water is ready for delivery it is the duty of the canal company to give notice to that effect, and, under the law, within six months thereafter the entryman must take up his residence on the land and continue to reside there until he has made his final proof. This he may do in any time from five weeks to three years, depending upon the time spent by him in reclaiming his land. In order to prove up, he must cultivate and reclaim one-eighth of each legal subdivision before final proof can be made.

TWIN FALLS LAND AND WATER COMPANY.

The largest and most important contract made in any State under the provisions of the Carey Act was the contract of January, 1903, made by the State of Idaho with the Twin Falls Land and Water

Company for the irrigation and reclamation of 270,000 acres of land situated in what was then Cassia and Lincoln counties. This project covered a magnificent body of land, the early reclamation of which had been prevented by reason of difficult engineering features, enormous cost, and inadequate security to the investor as well as distance from transportation. The contract with this company provided for the construction of a dam in Snake River, approximately 2,000 feet long and 80 feet in height, which should raise the level of the river 50 feet. Water was to be diverted on the south side of the river in what was then Cassia County, by means of a canal 80 feet wide on the bottom, 124 feet wide on the top, constructed to carry a depth of 10 feet of water, and having a length of approximately 80 miles. On the north side of the river water was to be diverted in a smaller canal for the irrigataion of 30,000 acres of land lying in Lincoln County. Construction work was commenced on the dam in the spring of 1903. On March 1, 1905, the construction of the dam was completed, the gates were raised, and water was turned into the first section of the canal covering 50,000 acres. Construction work was prosecuted vigorously, and the canal system on the south side of the river was finally completed in the fall of 1907. The main canal is now 83 miles long, and the approximate total length of all of the canals on the tract, including natural channels and farmers' distributaries, is 1,000 miles. The area covered is 215,000 acres. Water was first delivered for use under this canal system in the spring of 1905. One hundred and eighty-seven thousand acres under the canal has been settled upon, and at the present rate of settlement the remainder will probably be taken within the next twelve months. During the past year (1908) approximately 90,000 acres was in cultivation under this system and the remainder was being improved as rapidly as the resources of the settlers would permit. Under the law the required amount in cultivation on this tract, in order to make final proof, would be less than 25,000 acres, so that the cultivation actually done is nearly four times as great as required by law. In the beginning the average size of farms on this tract was 120 acres. It is now less than 80 acres, showing the tendency of irrigated tracts toward small farms and intensive cultivation.

Notwithstanding the large number of water users, nearly 2,400 in all, whose water contracts aggregate \$4,500,000, no judgment of foreclosure has been rendered in any case and the advanced payments made have exceeded the defaults. Water rights under this system were sold at \$25 per acre, a cash payment of \$3 per acre being required, the balance being paid in nine annual installments with interest at 6 per cent.

Under the plan provided by the law, the works are purchased by the settlers at the price per acre above specified and are finally turned over to an operating company composed of the settlers for management and control. This is the plan adopted on all projects in this State. In addition to building irrigation works, the company established towns, and some of those associated with it built telephone lines, waterworks, and electric power plants.

The land under this canal, together with the section of Cassia County adjoining on the south, was in 1907 established as a separate county and named Twin Falls County. The town of Twin Falls, the county seat, had in 1904 less than 400 population. The estimated present population (1908) is 4,000. It has two schoolhouses, one costing \$35,000 and the other \$54,000. Besides these it has the usual complement of churches and other public buildings as well as an electric light and telephone system, waterworks system, and a sewerage system costing \$100,000.

The Twin Falls Land and Water Company has made a proposal to the State which has been accepted for the irrigation of 32,000 acres in connection with the South Side project. It is planned to irrigate the land by means of pumps, utilizing for power a fall of 70 feet in one of the canals of the Twin Falls Land and Water Company.

TWIN FALLS NORTH SIDE CANAL.

The first plans contemplated that a canal should be taken out at the Milner Dam for the irrigation of 30,000 acres on the north side of Snake River in Lincoln County. Further surveys indicated that this amount might be very greatly increased at a very much larger cost, however.

In the spring of 1907 the Twin Falls North Side Land and Water Company purchased the rights of the Twin Falls Land and Water Company for the irrigation of this tract of 30,000 acres and entered into a contract with the State for the extension of the canal so as to cover in the aggregate 185,000 acres in Lincoln County. Work was immediately commenced upon the main canal, which had a width of 60 feet on the bottom, 110 feet at the top, and whose total length approximated 65 miles. The first section of this canal, covering what is known as the first segregation of 30,000 acres, was completed in the spring of 1908, and water delivered to the settlers on that tract. The remainder of the canal system will be completed by the spring of 1909, and water will be delivered to settlers on approximately 125,000 acres on what is known as the second segregation. This company filed its proposal with the State in June, 1908, for an extension of its canal beyond what is known as the first segregation to cover an

additional area of 50,000 acres. The extension would make the total length of the canal 100 miles and the total area under it 235,000 acres.

In addition to building the irrigation works, this company has arranged for the construction of 60 miles of railroad extending through this tract from Gooding to Milner. It has established the towns of Milner, Hillsdale, Jerome, and Wendell and is constructing hotels, waterworks, and electric-light plants in these towns and is extending a telephone system to cover the greater portion of the tract. In fact, it may be said that the company takes the desert, builds irrigation works, and completely furnishes the county with all of the modern comforts required by civilization. It has also advanced funds for the building of schoolhouses, so that schools will be ready immediately upon the taking up of their residence by the settlers. This method condenses within three or four years the progress which, under ordinary circumstances, requires twenty years, with the result that the water rights sold to settlers are greatly enhanced in value, to the great advantage of the settler, the towns become prosperous, and the progress of the entire tract is very rapid. This method also very largely increases the taxable property of the county and State, because titles are acquired as rapidly as possible by the settlers and extensive improvements are promptly made.

The Twin Falls North Side Land and Water Company has made a proposal to the State, which has been accepted, for the irrigation, by pumping, of 14,000 acres of land in the vicinity of the town of Milner, the power for which is to be furnished from a drop in the main canal.

SALMON RIVER PROJECT.

The same parties under the name of the Twin Falls Salmon River Land and Water Company entered into a contract with the State in April, 1908, for the reclamation of approximately 100,000 acres in Twin Falls County, south of the project of the Twin Falls Land and Water Company. Construction work was commenced and the land thrown open for settlement. Seventy thousand acres was entered within three days after the opening. The contract calls for the construction of a dam in the Salmon Falls River in township 14 south, range 15 east, to have a height of 210 feet and a length of 550 feet. This dam is to be constructed very largely of concrete upon plans adopted by the company after careful investigation and approval by the State engineer. A reservoir with a capacity of 180,000 acre-feet will be created by the building of the dam. The reservoir will be 15 miles long and of irregular shape. The main canal will be 30 miles long. It will be 35 feet wide on the bottom, 60 feet wide on top, and will carry 8 feet of water.

OAKLEY PROJECT.

The same organization has caused application to be made to the State for the segregation of 45,000 acres between the towns of Milner, Oakley, and Burley, in Cassia County. The application has been approved by the State board of land commissioners and a contract will probably be made with the State during the latter part of this year (1909). The work called for on this project is the building of a dam 135 feet high south of the town of Oakley and the storing of 65,000 acre-feet of water.

WEST EXTENSION OF THE TWIN FALLS CANAL.

The most extensive development as yet proposed under the Carey Act is the building of an extension to the canal of the Twin Falls Land and Water Company, heretofore referred to. The present canal is 83 miles long. It is proposed to extend this westward across Salmon Falls River so as to make the total length of the canal approximately 140 miles. This would require the enlargement of the canal to probably more than double its capacity, calling for a width of 200 feet or more at the water line. It is proposed to irrigate 570,000 acres west of the Salmon River in Twin Falls and Owyhee counties. The water supply will be supplemented by nine reservoirs located upon the tract, having a capacity of 450,000 acre-feet, and also by reservoirs on the headwaters of Snake River. The entire area developed by these irrigation systems, which cover what is generally known as the Twin Falls country, will be as follows:

Areas being reclaimed in the Twin Falls country.

Project.	Area.	Project.	Area.
Twin Falls Land and Water Co.	Acres. 215,000	North Side pumping plant.....	Acres. 14,000
Twin Falls North Side Land and Water Co.	235,000	Twin Falls Oakley project.....	45,000
Twin Falls Salmon River Land and Water Co.	100,000	Twin Falls Land and Water Co., west extension.....	570,000
South Side pumping plant.....	32,000	Total.....	1,211,000

The Twin Falls Land and Water Company's project is fully constructed and covers 215,000 acres. The project of the Twin Falls North Side Land and Water Company now covers 30,000 acres and in the spring of 1909 will cover 125,000 acres. The project of the Twin Falls Salmon River Land and Water Company will cover 100,000 acres in the spring of 1910. The pumping plants, the Twin Falls Oakley project, and the west extension of the Twin Falls Land and Water Company will follow later, but all of them will be completed by or before 1913.

AMERICAN FALLS CANAL AND POWER COMPANY.

One of the first segregations made in the State of Idaho under the Carey Act was that of the American Falls Canal and Power Company, embracing 57,000 acres of choice land lying on the west side of Snake River between the towns of Blackfoot and American Falls. This is a comparatively level valley 60 miles long and 6 to 8 miles wide, sloping to the southeast and draining into the Snake River. The soil is exceptionally rich and productive; the altitude about the same as Salt Lake, Utah, 4,400 feet; the latitude that of Spain and Italy. The best of water for domestic and culinary purposes is obtained from wells at a depth of 30 to 60 feet, which fill rapidly with water to a depth of 15 to 20 feet. The sun shines nearly every day of the year and the climate is ideal for agricultural and horticultural purposes.

In 1895 the American Falls Canal and Power Company appropriated 1,250 cubic feet of water per second from the Snake River. It has spent nearly a million dollars on its canal and ditches and is now irrigating lands under the three openings in the segregation. The main canal, which is 85 feet wide at the top and 70 feet at the bottom and has a carrying capacity of 6 feet of water, has been completed for a distance of 70 miles. The Low Line has been finished for approximately 25 miles, and also numerous branches and laterals. The canal decreases in width and capacity as the various branches are taken out. On the entire canal there is but 12 feet of wooden flume, the balance being earth and stone construction, bringing 80,000 acres under irrigation, of which there remains unsold some 15,000 acres of Carey Act land.

Lands are purchased from the State at 50 cents an acre, one-half cash and the balance when proof is made. Water rights are sold at \$15 per acre in the first opening, \$20 per acre in the second, and \$25 per acre in the third, on easy terms; \$3 per acre cash, \$2 per acre at the end of the second year, and the balance in eight equal annual installments, deferred payments bearing interest at the rate of 6 per cent per annum. Payments other than above may be made on principal at any time, and interest stops on any payments so made. Many settlers have already made proof on their lands, and approximately 20,000 acres were cultivated in 1908. At least 150 permanent dwellings, some of them attractive modern brick structures, have been erected and are occupied by an intelligent, industrious class of farmers from the Middle West. School districts have been formed and steps taken for the erection of school buildings and churches. A number of orchards have been planted and large crops of grain and vegetables are being harvested, wheat running as high as 40 bushels to the acre, oats from 60 to 90 bushels, weighing 46 pounds to the bushel.

Potatoes, onions, and garden truck are of exceptionally fine quality, and the yield per acre is large. Alfalfa and other tame grasses are being sown, and within a comparatively short time the entire valley will be covered with highly cultivated and improved farms.

A railroad running from the main line of the Oregon Short Line Railway at American Falls through this tract to Blackfoot has been surveyed and town sites established at Aberdeen and Springfield, with daily mail service.

THE MARYSVILLE CANAL AND IMPROVEMENT COMPANY.

In 1906 the Marysville Canal and Improvement Company (Limited) engaged in the segregation and reclamation of certain lands lying in townships 8 and 9, ranges 42, 43, and 44 east of Boise meridian, in Fremont County, eastern Idaho. This project will be completed soon. The main canal is about 15 miles long and has a capacity of 264 cubic feet per second and serves a tract 10 to 13 miles long and 3 to 5 miles wide. The water supply is abundant, the appropriation exceeding the amount needed for all lands in the segregation. The source of supply is Fall River, a tributary of Snake River, and gives a never-failing flow throughout the entire season. Five-eighths inch of water is allowed for each acre. This is sufficient to put water over each acre of land in forty days to a depth of 1 foot.

Ashton is the principal town on the tract and is an excellent business point. It has a population of 750, and all lines of business are represented. While only three years old, it has some first-class buildings which, in general, are exceedingly well built. The public schools are very good. Marysville is the pioneer town of this section and is 1.5 miles from Ashton. St. Anthony, about 15 miles to the southwest, is the county seat. The Oregon Short Line branch to Yellowstone Park traverses the center of the district.

The soil is of excellent quality and is particularly valuable for the raising of grains and sugar beets. The land is splendidly adapted to irrigation and holds moisture well. On a conservative basis the average yields per acre on the entire tract are as follows: Wheat, 35 to 50 bushels; oats, 50 to 75 bushels; barley, 40 to 75 bushels; alfalfa, 3 to 5 tons; timothy, 3 to 4 tons; sugar beets, 10 to 20 tons. Yields doubling these amounts are sometimes harvested.

The lands, as in all cases under the Carey Act, are sold by the State at 50 cents per acre—25 cents per acre when entry is made and 25 cents at the time final proof is submitted. The price for water rights is \$20 per acre, on the following terms: \$2.50 per acre on entry and the balance in nine annual installments, with interest at 6 per cent per annum on deferred payments.

THE IDAHO IRRIGATION COMPANY.

The Idaho Irrigation Company is developing a large project along the Oregon Short Line Railroad in Blaine and Lincoln counties. The lands to be irrigated under this enterprise lie in the above-named counties, in the vicinity of Big and Little Wood rivers, and comprise about 110,000 acres of public lands segregated under the Carey Act. Other lands in private ownership under the system aggregate about 15,000 acres. In addition, the company has recently applied for a further segregation, bringing the total to about 150,000 acres.

The lands are located near Shoshone and Gooding, and the main line of the Oregon Short Line and the Ketchum branch of that road pass through the tract. These lands lie north of and are of the same general character as the Twin Falls tract, which was opened in 1905, and which has proved such a pronounced success, and it is not too much to add that the success of the Twin Falls project has given great impetus to all other Carey Act projects in the State. The soil is of very good quality for agricultural purposes and consists of a deep, finely divided, dark-brown loam. The general slope of the surface is such as to facilitate the process of irrigation. The climatic conditions are very good for plant life. Under irrigation excellent crops of alfalfa, sugar beets, wheat, barley, oats, potatoes, apples, plums, pears, and other fruits will be produced. In other words, practically all cereals, tubers, and fruits indigenous to the Temperate Zone can be successfully raised, large yields being obtained.

The water for the irrigation of these lands will be obtained from Big and Little Wood rivers, important tributaries to the Snake. During the latter part of the season the natural flow of these streams will be supplemented by waters impounded in a reservoir to be constructed by the company. The reservoir site is extremely good and will impound sufficient water to provide against all needs in the irrigation of at least 150,000 acres. The company has taken all necessary steps looking to the appropriation of waters and the perfection of the necessary legal title thereto, the general plans of the proposed system having been submitted to the State engineer and having obtained his approval. These plans contemplate the construction of an impounding dam, together with diversion dams, canals, and laterals for the irrigation of about 125,000 acres, but can be increased with a reasonably small expenditure to furnish water for 150,000 acres.

Payment for water rights is made in ten annual installments, which amount to \$35 per acre, with interest at 6 per cent on all deferred payments. Interest begins to accrue when water is delivered to the land. The second annual payment is not due until water has been delivered over the entire section. Water will be available for 50,000

acres in 1909, and the remainder of the water will be supplied one year later.

PORTENEUF-MARSH VALLEY IRRIGATION COMPANY.

The Portneuf-Marsh Valley Irrigation Company is proceeding to reclaim about 20,000 acres near the town of Downey, in Bannock County, about 40 miles southeast of Pocatello. Twelve thousand acres of this land has been segregated under the provisions of the Carey Act and the remainder is private land and Government land still open to entry. The plans of the company for the reclamation of this tract include the construction of a reservoir to impound the water of the Portneuf River in the vicinity of Chesterfield, on the upper Portneuf, and the diversion of the water at a point near Downey. About 50 miles of canals and laterals will constitute the distributing system. The tract of land to be irrigated lies within 6 miles of the Oregon Short Line Railroad. It lies in a succession of rolling benches, and constitutes one of the most beautiful and fertile areas in the State.

On September 7, 1908, the State land board threw open to entry the Carey Act lands under this project, and within a few days practically one-half of the land had been entered. The price of water rights is \$35 per acre, the terms being \$3 cash at the time of entry and the remainder in nine equal annual installments, with interest at 6 per cent on deferred payments.

Owing to the choice character of the land and the great demand for it, the State land board, at the request of the irrigation company, decided to restrict entries on this tract to 80 acres each. The soil is a mixture of exceptionally fertile volcanic ash and loam many feet deep and entirely free from any rock or lava outcroppings. This tract will doubtless prove to be one of the finest areas in the State, being especially adapted to grain, hay, sugar beets, and the hardier fruits.

THE KING HILL IRRIGATION AND POWER COMPANY.

On May 1, 1908, a contract was entered into between the State board of land commissioners, on behalf of the State, and the King Hill Irrigation and Power Company, the company agreeing to construct and complete within three years the irrigation project previously undertaken by the Glenns Ferry Land and Irrigation Company. The King Hill Irrigation and Power Company purchased and took over the segregation and all the assets of the old company and immediately commenced pushing the work of construction vigorously. The segregation covers about 14,000 acres of very fertile land lying in a cove surrounded by high bluffs along the south side

of Snake River and extending from Glenns Ferry to a point opposite Bliss, being tributary to the towns of Glenns Ferry, Bliss, and King Hill, which are all on the main line of the railroad along the river.

The principal office of the company is at Boise, and the headquarters for the land business are at the new town of King Hill, which this company has laid out. A very successful "land opening" was held at King Hill, October 12, 1908. By February, 1909, about three-fourths of the tract had been filed on. Construction is being rushed, and the delivery of water will begin with the opening of the irrigation season of 1909.

On account of the great cost of the irrigation per acre and the high grade of the soil (it being mostly fitted for fruit and high-class farming), the State land board fixed a price of \$65 per acre, to be paid in ten equal payments. An ample supply of water for the irrigation of these lands will be obtained from the Malad River, the company having obtained legal title to the use of the waters of that stream in an amount sufficient to meet all needs. An excellent dam is being built across that river about 1 mile from Snake River. Three hundred cubic feet per second will be carried across Snake River in a 6-foot inverted siphon pipe resting on a steel truss bridge 300 feet long. The canal for the first 20 miles will have a capacity sufficient to carry water to irrigate more than 20,000 acres, besides supplying the towns of King Hill, Glenns Ferry, and the lands tributary on the north side of the Snake River. This company is building a telephone line along its construction and to the town site of King Hill, to which the greater part of the segregated lands are tributary, and this telephone line will be turned over to the settlers, as a part of the project, who can then operate it along with the maintenance of the ditch. It has constructed a ferry, with a boat, opposite Bliss and one at King Hill, besides providing a ferry between the two places. Glenns Ferry is already equipped with two ferries, thus giving ample facilities for the conveyance of settlers to the railroad points lying along and adjacent to the segregated lands. All of the material used in the construction of the flumes and bridges is of the best Oregon fir, and is being put in in the most durable and lasting manner. It is the purpose or plan of this company to have a continuous supply of water throughout the entire year.

CANYON CANAL.

The Canyon Canal covers about 20,000 acres on the Emmett bench, north of the Payette River, opposite the town of Emmett, and about 3,500 acres on the south side of the river, surrounding Emmett, this land being the upper end of the famous Payette Valley. Water is

diverted from the Payette River at a point about 18 miles up the river from Emmett and about 4 miles from Marsh. The water is raised about 10 feet by means of a timber crib and rock dam across the river, is diverted through two 14-foot segmental head gates built in solid rock, and is carried through a main canal 20 feet wide on the bottom at its head, with a water depth of 5 feet. This canal has a total length of almost 33 miles. The first 14 miles is through the canyon of the Payette River, requiring three tunnels and quite a little fluming, with no land susceptible of irrigation under it, after which the canyon opens out, forming a tract of exceptionally fine fruit land about 17 miles long by 3 miles wide, known as the "Emmett bench." At the head of this bench a branch canal is carried across the river by means of a suspension bridge and inverted siphon, delivering water to about 3,500 acres east and south of Emmett. The capacity of the main canal is 300 cubic feet per second and of the south side branch about 50 cubic feet per second. The water supply is abundant, being taken from the Payette River, one of the steadiest streams as to normal flow in the State. The company has taken the necessary steps leading to the perfecting of title to the use of necessary waters.

The first season of water is just closing and has been very successful, both for the entrymen and the canal company. Lands have increased in value from \$10 to \$100 per acre in some instances, and this without the water. A number of Grand Valley (Colo.) fruit growers have purchased lands under this canal system, and are getting ready to plant trees in the fall and spring. The lands on the Emmett bench are regarded by them as being ideal for winter apples, while the farms surrounding the town of Emmett, on the south side of the river, are noted for the excellence of their peaches, and, in fact, all fruits.

The principal town of this tract is Emmett, with a population of about 2,300. Emmett is the terminus of the Idaho Northern Railway, which connects with the main line of the Oregon Short Line Railway at Nampa, 30 miles distant, and is a wide-awake, thriving, and modern little city, well represented in all lines of business and the professions, with excellent school systems, churches, and public improvements. Water is sold for \$30 per share of five-eighths inch, which is the amount furnished each acre, and is dedicated and made appurtenant to particular lands and forever applies to those lands and to no other. This amount is payable in ten annual installments of \$3 each. There are no maintenance charges to be paid by the entrymen until such time as they take over the system.

THE BIG LOST RIVER LAND AND IRRIGATION COMPANY.

A tract of about 81,000 acres, located on the western side of the Snake River Valley, at the intersection of Blaine, Bingham, and Fremont counties, has been segregated by the State to be reclaimed by the Big Lost River Land and Irrigation Company. The Snake River branch of the Oregon Short Line Railway passes directly through this land with terminus at May, in the Lost River Valley. This valley forms a gateway into the center of the great mountain ranges of central and northern Idaho, which contain in a more or less undeveloped state all the different kinds of minerals produced in the United States. This region will furnish a good market for the surplus product of the soil raised upon the Big Lost River tract.

Although this section has acquired a reputation as a winter-wheat country, it is capable of diversified farming. Wheat, oats, barley, clover, timothy, flax, alfalfa, sugar beets, and potatoes make very good yields. Excellent apples, prunes, pears, and small fruits are grown. The most profitable crop in this section is that of sugar beets, the land being especially adapted to that industry. Twenty tons per acre is not an uncommon yield, and the crop is marketed at the beet-sugar factory at Blackfoot at \$4.50 per ton. Alfalfa sells for \$4 to \$8 per ton in the stack, timothy for \$10 to \$12 per ton, potatoes at \$1.50 to \$4 per hundred pounds. The prices of other farm commodities compare favorably with the prices quoted above.

The terms upon which water rights are sold are as follows: \$25.50 and \$30.50 per acre, according to selection; \$3.25 per acre at time of contract is entered into with the company, the balance to be paid in ten annual installments with 6 per cent interest on deferred payments.

IRRIGATION LAWS AND THEIR ADMINISTRATION.

In the early days of California it soon became evident that the restriction of the use of waters to the old common-law rule of riparian rights would, in a very large measure, retard the development of the mining industry, and hence to meet conditions which were entirely new to the pioneer, the custom of appropriating the waters of the public domain, regardless of any consideration of the law of riparian rights, became the general rule. This custom of appropriation eventually became law, and was as applicable to the development of agriculture in the arid section as it was to the development of the mining industry.

The custom which had been developed in California soon spread to all arid sections where the miner ranged in search of gold. In the early days, certain sections now a portion of the State of Idaho were

second only to California in the production of gold, and the custom of appropriating water by diversion from natural channels soon became prevalent here. Along with the appropriation for mining purposes appropriation for irrigation became the rule. It was not until 1881, however, that the legislature of the Territory of Idaho passed the first act with reference to the appropriation of public waters. There are, however, a large number of water rights in the State dating back to the seventies, and some as far back as the sixties. These rights have always been recognized by the courts of the Territory and State, being based upon the customs of the country, as well as upon the Federal enactments of 1866 and 1870, covering the appropriation and use of water flowing through the public domain for mining, agricultural, manufacturing, or other purposes.

The law of 1881 established a system of procedure whereby the appropriator made public record of his intention to appropriate waters. This was done by posting a notice at the intended point of diversion and recording a copy of the notice in the county recorder's office. In 1895 the State engineer's office was established and appropriators of public waters were required to record their notices, not only with the county recorders, but also in the office of the State engineer. If due diligence were shown in the matter of diverting and putting the water to a beneficial use, the date of priority eventually fixed by court decree was the date of the posting of the notice at the point of diversion. This is known as the doctrine of "relation back." In 1903, a new system of procedure was established by the legislature with reference to the appropriation of public waters. This law, with a few minor changes, is still in effect. Under its provisions a person desiring to appropriate water must file with the State engineer an application for a permit. He must declare his name and post-office address, the name of the stream or other source of supply, the quantity of water claimed, stated in cubic feet per second of time, and the use for which the water is desired. He must also describe in a general way the works of diversion which he intends to build, the estimated cost and the time which, in his opinion, it will take to construct the works, and also the additional time required to put the water to beneficial use after the completion of the works. Beneficial use with reference to an irrigation right means the use of the water in producing a crop upon cultivated ground. The applicant is also required to file maps in duplicate, showing the source of supply, the point of diversion, the route of the ditch and the lands to be irrigated, or, in case of power appropriation, the point where power will be developed and the point where water will be returned to the stream after use. If the appropriation definitely states the source of supply, the amount claimed, the point of diversion, and the use, but is incomplete as to other mat-

ters, the State engineer files the application, gives it a number, and returns it to the applicant with a letter informing him as to these points in which the application is deficient. The applicant then has sixty days within which to file with the State engineer completed and corrected application and maps, still retaining as his date of priority the date upon which his application was accepted and filed in the State engineer's office. A filing fee is required, \$1 being charged for the first cubic foot per second and 10 cents additional for each additional foot or fraction thereof.

After the application and maps, in completed form, are filed with the State engineer that official promptly approves the application, and it thereby becomes a permit and, after having been recorded in full, is returned to the applicant and is evidence of his having properly initiated his right. Within sixty days from the date upon which the State engineer approves the application the holder of the permit must begin the works of diversion if his appropriation does not exceed 25 cubic feet per second. If it exceeds that amount he is not required to commence work at any specified time, but within sixty days from the date upon which his application is approved by the State engineer he must file with that official a bond running to the State of Idaho, conditioned upon faithfully carrying to completion the works of diversion as specified in the application and permit. Failure to comply with the provision as to commencing work or as to filing bond is declared by statute to be deemed an abandonment of all rights under the permit. The limit set by the statute for the completion of works of diversion is five years from the date of the approval of the application and issue of the permit. This limit, however, can in any case be shortened by the State engineer at his discretion. The permit holder is further required to do one-fifth of the work within one-half the time allowed for the completion of the whole. At the expiration of the period for completion the permit holder must signify his intention to make the required proof. Thereupon the State engineer publishes notice to the effect that on a certain day the permit holder will submit proof to the effect that he has completed his works of diversion as required by law, the notice naming the place and the person before whom proof will be offered. The permit holder is required to furnish his own deposition and the depositions of two disinterested witnesses attesting the facts with reference to the completion of works. The works are examined by some engineer appointed by the State engineer and upon the report forthcoming from the said examination, together with the facts established by the depositions above mentioned, the State engineer issues a certificate of completion of works, certifying to the fact of such completion.

Within four years from the time proof of completion is made the permit holder must submit proof of beneficial use. That is to say, he

must make showing to the effect that the waters applied for in his original application have been put to the use for which they were claimed. The procedure as to publication notice, engineer's examination, and depositions of holder and two witnesses is practically the same as is required for proof of completion, except that the first proof is required for the purpose of establishing the fact that works sufficient to divert a certain quantity of water have been constructed, while the second proof is required for the purpose of showing that the waters thus diverted have been actually used. After the permit holder has made such proof of beneficial use the State engineer issues to him a license confirming his right to use the quantity of water which he has shown upon his proof to have been actually used for the purposes for which it was appropriated. The amount of water granted under the license can not exceed the amount originally applied for, nor can it exceed the amount which the works are capable of diverting nor the amount shown to have been actually used. To illustrate, the appropriator in his application may claim 10 cubic feet of water. Later he may make proof that his works are capable of diverting 5 cubic feet per second, but no more, while on his last proof he may show that he has used only 2.5 cubic feet per second. His license will grant him the right to the latter amount. He may, however, make a second proof of beneficial use and gain the right to an additional amount of water, not, however, exceeding the capacity of his works as fixed in his certificate of completion. The license is the last step in the perfecting of a water right under the provisions of the law now in force and might be termed a "water patent."

The procedure above referred to applies only to water rights initiated since the enactment of the present water law; that is, since March 11, 1903. Rights initiated prior to that time, to be finally fixed and determined, must be adjudicated through the district courts of the State, for which a special procedure is provided. Under this system of procedure all the users upon a stream or streams tributary thereto are united in one suit, either as plaintiffs or defendants. The State engineer is directed by the judge of the district court to make surveys and certify plats and reports to the court showing the various ditches, together with their capacities and the lands served thereby. Evidence is then submitted touching each individual right sought to be established. At the conclusion of the testimony the court grants a decree vesting in the several parties to the suit such rights to water as may have been established by competent and sufficient testimony. This decree fixes the amount to the use of which each party is entitled and also establishes date of priority.

The State engineer is charged with the distribution of appropriated waters according to the rights established either by license or by court

decrees. The State is divided into three water divisions, each of which is under the supervision of a water commissioner. Each water commissioner, at the beginning of the irrigation season, appoints a number of water masters to patrol the streams in his division upon which licensed or decreed rights are found and distribute the water according to the priority of such rights. So long as there is water sufficient for all appropriators the matter of priority is of no particular importance, but in case of shortage of water it becomes the duty of the water master to see that the earlier appropriators are served, although the later appropriators may suffer. To illustrate, in the case of three rights, one established in 1870, the second in 1880, and the third in 1890, in the event of shortage the two earlier rights would receive their full amount and the last would have what surplus there might be. If there were enough to supply only one of the rights, the 1870 right would receive all the water and the two later ones none at all. This, in simple terms, is an application of the law of priority in the use of water and the equitable principle upon which it is based is expressed in the words "first in time, first in right"

SETTLEMENT OF LANDS UNDER IRRIGATION.

As stated heretofore, for the last quarter of a century and more individual enterprise in the appropriation of water has given way more and more to municipal and corporate enterprise. This for the reason that naturally opportunities for irrigation susceptible of development by individual effort have in the main been exhausted. It is true that here and there waters are still available to the individual and are thus appropriated: The settler makes desert entry under the Federal land laws upon a certain tract of land not exceeding 320 acres and files upon waters sufficient to irrigate his tract. He then proceeds to lead the water upon the land by means of adequate diversion works consisting of a dam and ditches, or sometimes merely the latter. In these cases it frequently happens that the settler has few resources aside from his own labor and whatever farming equipments he may possess. Naturally some difficulties beset him, but in the majority of cases his efforts are crowned with success. Sometimes three or four settlers join in the construction of a partnership ditch, each obtaining the water necessary for the irrigation of his particular tract of land. In this way the proportionate cost to each settler is lessened.

The lands included within projects under development by the Reclamation Service are subject to the Federal homestead law and are entered under the provisions of that law. The settler is bound to pay for his water right, the payments extending over a period of ten years and based upon the cost of constructing the necessary diversion works.

Under the Carey Act the settler first purchases a water right from the water company at the price per acre which has been agreed upon between the State board of land commissioners and the water company. This price ranges from \$30 to \$65 per acre, according to the tract. At the time contract is entered into the settler pays the company a portion of the total price, usually \$3 per acre, the balance to be paid in nine annual installments, with interest at 6 per cent on deferred payments. After contract is made the settler makes entry upon the lands desired by filing in the office of the State board of land commissioners and paying 25 cents per acre on the lands entered. As soon as water is ready for delivery to the lands the settler is so notified by the company. Residence is then established and patent may be obtained as soon as satisfactory proof is submitted to the effect that one-eighth of the land has been actually cultivated. At the time of making proof the entryman pays to the State 25 cents per acre and his title to the land becomes absolute. Naturally, however, the unpaid installments on the water right constitute a lien upon the land. The majority of the settlers who file upon Carey Act lands come from the irrigated districts of Oregon, Washington, Colorado, and Montana. The following Central States also furnish a large number of settlers: Kansas, Nebraska, Iowa, North Dakota, South Dakota, and Illinois. The greater part of these people have sufficient funds to make the first payment on the land and water and to put fair improvements on the land and a considerable acreage into cultivation.

To many people unfamiliar with irrigation the process is looked upon as something mysterious, and a fear of failure in embarking upon such an enterprise sometimes causes hesitation on the part of those who otherwise would move to the arid West and undertake the building of a home. This fear is not well founded, for the reason that any intelligent man who will avail himself of the various aids at his command may so familiarize himself with the principles of irrigation as to make success of his venture a certainty. Bulletins from various experiment stations can be had for the asking, giving results of the latest developments in practical irrigation. Text-books at moderate cost can be obtained in which are discussed the various problems of irrigation and their solution. One of the greatest aids along these lines is to be found in the work of the Irrigation Investigations of the Office of Experiment Stations, United States Department of Agriculture, which from time to time issues bulletins covering the problems of irrigation. The cost of improvement of lands varies somewhat, according to location. Where there is a heavy growth of sagebrush the clearing of the land under contract ranges from \$3 to \$4 per acre. Seeding costs from \$1.50 to \$2.50 per acre, according to the kind of seed used. Other improvements will be in accordance with the wants and financial ability of the settler. The funds neces-

sary for a settler in order to improve his land, for the clearing of sagebrush, leveling, plowing, seeding, and fencing, together with modest improvements in the way of house and barn, range from \$15 to \$20 per acre. It is hardly wise to figure on less than this estimate.

The lands, once developed to a high state of cultivation, range in value from \$150 to \$300 per acre. Fruit lands run far above these figures.

FUTURE DEVELOPMENT IN IRRIGATION FARMING.

It might appear from a cursory examination of the present situation relative to irrigated lands that the field had been practically developed. This, however, is not the case in Idaho. In fact, it may truthfully be said that irrigation here is in its infancy. This for two reasons: (1) Hundreds of thousands of acres are now unirrigated which will eventually receive water, and (2) with the improvements in methods, both in the matter of conserving water and in more scientific handling of the soil, the producing power of each individual acre will be greatly increased.

Intensive farming is rapidly becoming the slogan of practical irrigators, and to the effective carrying out of this idea must be brought all the experience and scientific research of those who make a special study of the problems demanding solution. Now, as never before, the experience and training of the specialist in these lines are demanded.

As regards the question of irrigation law, it should be borne in mind that the legislatures from session to session have been compelled to adopt a "cut and try" policy. This for the reason that conditions have constantly been met for which no precedent could be found. Little by little, however, the laws covering the control and use of water have been bettered, until to-day Idaho possesses what, in many respects, may be considered a model code of water laws. Probably what is needed most now is legislation which will bring about as rapidly as possible a thorough adjudication of water rights on all the streams and sources of supply. This will be a large undertaking, but such a course is demanded by the need of a full and final determination of all rights to the use of water within the State.

The question of relative rights between the citizens of different States claiming water from interstate streams should also be determined upon some equitable basis and in a manner to best preserve the rights of all, regardless of State lines. Such a course appears to be the trend of the courts, but specific legislation along this line should be enacted, to the end that the question may be so fully fixed and determined as to minimize, as far as possible, vexatious and expensive litigation.

